GURU KASHI UNIVERSITY
PUNJAB - INDIA

Program Syllabus Booklet

Bachelor of Sciences
(B.Sc. Non-Medical-610)

Session: 2021-22

University College Of Basic Science and humanities
Guru Kashi University, Talwandi Sabo

GURU KASHI UNIVERSITY
PUNJAB - INDIA

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Annexure -1

Program: Bachelor in Science (Non-Medical) (B.Sc. NM)

Program code: 610

Program Outcome (PO): The Program Outcome for the Bachelor in Science Non-Medical (B.Sc NM) program are the following:

PO	Statements
PO1	To Acquire the knowledge with facts and figures related to various subjects in pure sciences.
PO2	To identify, analyze, evaluate and apply information scientifically to solve problems.
PO3	To enhance Critical thinking and analytic reasoning to employ critical thinking in understanding the concepts in every area of Math, physics and chemistry to analyze the results.
PO4	To use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	To learn the laboratory skills needed to design safely and interprate different instruments with an understanding of the limitations.
PO6	To develop flair by participating in various social and cultural activities in environmental context, and demonstrate the knowledge of, and need for sustainable development.
PO7	To identify unethical behavior such as fabrication, falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects.
PO8	To gain confidence for self and continuous learning to improve knowledge and competence as a member or leader of a team also provide skill to work independently and do in-depth study of various notions of Physics, ,Math,, chemistry.
PO9	To Communicate various concepts of mathematics effectively using examples and their geometrical visualizations to use mathematics as a precise language of communication in other branches of human knowledge.
PO10	To think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

Program Specific Outcome (PSO): The Program Specific Outcome for the Bachelor in Science (B.Sc NM) program are the following:

PSO	Statements
PSO1	To develop problem solving skills, cultivating logical thinking, andface competitive examinations with confidence. To enhance numerical ability and address problems in interdisciplinary areas which would help in project and field works.
PSO2	To enhance entrepreneurial skills, become empowered andself dependent in society ,understand the professional, ethical, legal, security, social issues and Responsibilities. And also apply knowledge of principles, concepts and results in specific Course area to analyze their local and global impact. Furthermore, To acquire a strong foundation in various branches of mathematics to formulate real life problems into mathematical models.
PSO 3	To apply the mathematical knowledge and skills to face competitive examination with confidence. And pursue higher studies which in turn will offer them job opportunities in government and public sector undertaking banks, central government institutes etc.

Study Scheme										
Semester: 1st										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	A610101	Algebra	T	3	0	0	3	50	50	100
2	B610102	Calculus	T	3	0	0	3	50	50	100
3	A610103	Co-ordinate Geometry-I	T	3	0	0	3	50	50	100
4	B610104	Electricity and Magnetism-I	T	3	0	0	3	50	50	100
5	A610105	Mechanics-I	T	3	0	0	3	50	50	100
6	A610106	Waves & Oscillations-I	T	3	0	0	3	50	50	100
7	A610107	Inorganic Chemistry-I	T	2	0	0	2	50	50	100
8	610108	Organic Chemistry -I	T	2	0	0	2	50	50	100
9	A610109	Physical Chemistry-I	T	2	0	0	2	50	50	100
10	610112	History of Punjab-I	T	3	0	0	3	50	50	100
11	610110	Physics-I Lab	P	0	0	4	2	60	40	100
12	610111	Chemistry-I Lab	P	0	0	4	2	60	40	100
Total No. of Credits				31						

Semester: 2nd										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	A610201	Differential Equations	T	3	0	0	3	50	50	100
2	610202	Modern Algebra	T	3	0	0	3	50	50	100
3	610203	Probability and Statistics	T	3	0	0	3	50	50	100
4	A610204	Electricity and Magnetism-II	T	3	0	0	3	50	50	100
5	B610205	Mechanics-II	T	3	0	0	3	50	50	100
6	A610206	Waves and Oscillations-II	T	3	0	0	3	50	50	100
7	A610207	Inorganic Chemistry-II	T	2	0	0	2	50	50	100
8	610208	Organic Chemistry-II	T	2	0	0	2	50	50	100
9	A610209	Physical Chemistry-II	T	2	0	0	2	50	50	100
10	610212	History of Punjab-II	T	3	0	0	3	50	50	100
11	610210	Physics-II Lab.	P	0	0	4	2	60	40	100
12	610211	Chemistry-II Lab	P	0	0	4	2	60	40	100
Total No. of Credits							31			

Semester: 3rd										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	A610301	Advanced Calculus	T	3	0	0	3	50	50	100
2	A610302	Analysis-I	T	3	0	0	3	50	50	100
3	A610303	Mechanics-I (Statics)	T	3	0	0	3	50	50	100
4	A610304	Statistical Physics and Thermodynamics-I	T	3	0	0	3	50	50	100
5	A610305	Optics	T	3	0	0	3	50	50	100
6	A610306	Quantum Mechanics	T	3	0	0	3	50	50	100
7	610307	Inorganic Chemistry-III	T	2	0	0	2	50	50	100
8	610308	Organic Chemistry-III	T	2	0	0	2	50	50	100
9	610309	Physical Chemistry-III	T	2	0	0	2	50	50	100
10	610312	English-I	T	3	0	0	3	50	50	100
11	610310	Physics-III Lab.	P	0	0	4	2	60	40	100
12	610311	Chemistry-III Lab.	P	0	0	4	2	60	40	100
Total No. of Credits				31						

Semester: 4th										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	610401	Linear Algebra	T	3	0	0	3	50	50	100
2	610402	Analysis-II	T	3	0	0	3	50	50	100
3	610403	Mechanics-II (Dynamics)	T	3	0	0	3	50	50	100
4	A610404	Statistical Physics and Thermodynamics-II	T	3	0	0	3	50	50	100
5	A610405	LASER Physics	T	3	0	0	3	50	50	100
6	A610407	Inorganic Chemistry-IV	T	2	0	0	2	50	50	100
7	610408	Organic Chemistry-IV	T	2	0	0	2	50	50	100
8	A610409	Physical Chemistry-IV	T	2	0	0	2	50	50	100
9	610412	English-II	T	3	0	0	3	50	50	100
10	610413	Atomic Spectroscopy	T	3	0	0	3	50	50	100
11	610410	Physics-IV Lab.	P	0	0	4	2	60	40	100
12	610411	Chemistry-IV Lab.	P	0	0	4	2	60	40	100
Total No. of Credits				31						

Semester: 5th										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	A610501	Numerical Methods	T	3	0	0	3	50	50	100
2	**Elective – I**		T	3	0	0	3	50	50	100
3	A610503	Number Theory-I	T	3	0	0	3	50	50	100
4	A610504	Condensed Matter Physics-I	T	3	0	0	3	50	50	100
5	A610505	Electronics and Solid State Devices-I	T	3	0	0	3	50	50	100
6	A610506	Nuclear and Particle Physics-I	T	3	0	0	3	50	50	100
7	610507	Inorganic Chemistry-V	T	2	0	0	2	50	50	100
8	610508	Organic Chemistry-V	T	2	0	0	2	50	50	100
9	A610509	Physical Chemistry-V	T	2	0	0	2	50	50	100
10	610512	Fundamentals of Computers	T	2	0	0	2	50	50	100
11	610510	Physics-V Lab.	P	0	0	4	2	60	40	100
12	610511	Chemistry-V Lab.	P	0	0	4	2	60	40	100
13	610513	Fundamentals of Computers Lab.	P	0	0	2	1	60	40	100
Total No. of Credits				31						

Elective – I (Choose Any One)										
1	A610502	Co-ordinate Geometry-II	T	3	0	0	3	50	50	100
2	610514	Group Theory	T	3	0	0	3	50	50	100

Semester: 6th										
Sr.	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	610601	Metric Space	T	3	0	0	3	50	50	100
2	610602	Complex Analysis	T	3	0	0	3	50	50	100
3	A610603	Operations Research and Linear Programming	T	3	0	0	3	50	50	100
4	A610604	Condensed Matter Physics-II	T	3	0	0	3	50	50	100
5	A610605	Electronics and Solid State Devices-II	T	3	0	0	3	50	50	100
6	**Elective –II**		T	2	3	0	0	3	50	50
7	A610607	Inorganic Chemistry-VI	T	2	0	0	2	50	50	100
8	610608	Organic Chemistry-VI	T	2	0	0	2	50	50	100
9	A610609	Physical Chemistry-VI	T	2	0	0	2	50	50	100
10	A100302	Environmental Science	T	3	0	0	3	50	50	100
11	610610	Physics-VI Lab.	P	0	0	4	2	60	40	100
12	610611	Chemistry-VI Lab.	P	0	0	4	2	60	40	100
Total No. of Credits				31						

Elective – II (Choose Any One)										
1	A610606	Nuclear and Particle Physics-II	T	2	0	0	2	50	50	100
2	610612	Nano Science	T	2	0	0	2	50	50	100

Course Name: Algebra
Course Code: A610101
Semester 1st

Course Outcomes (CO):

On completion of this course, the student will be able to:

CO	Statements
CO1	Demonstrate the concept of Matrices including its types, classifications, operations and applications to solve complex problems.
CO2	Derive the equations and compute symmetric functions of roots in terms of coefficients.
CO3	Explain the properties of Eigen values of the matrices .Also, find Eigen values and Eigen vectors of a given matrix
CO4	Define Nature of roots of an equation with the help of Descartes' rule of signs and Cardons method. Also, Solution of Biquadratic equations.

Credits 03 **L T P**
3 0 0

Course Contents

Unit - I

Linear dependence and independence of row and column matrices. Row rank, Column rank and their equivalence. Eigen values, Eigen vectors and the characteristic equation of a matrix, Properties of Eigen values for special type of matrices,Diagonalization, Cayley-Hamilton theorem.

Unit - II

Applications of matrices to a system of linear (both homogeneous and non homogeneous) equations. Rules on consistency of a system of linear equations.

Unit - III

Relations between roots and coefficients of a general polynomial equation in one variable. Solution of polynomial equations having conditions on roots. Transformation of equation.

Unit - IV

Nature of roots of an equation. Descartes' rule of signs. Solution of cubic equations (Cardons method). Biquadratic equations and their solution.Polar representation of complex numbers, nth roots of unity De Moivre's theorem and its application, Direct and inverse circular functions, hyperbolic and logarithmic

functions. Summation of series.

Reference books:

1. Kurosh, (1982). *Higher Algebra*, MIR Moscow.
2. David C. Lay, (2007). *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian reprint.
3. S.H. Friedberg, A.J. Insel and L.E. Spence, (2003). *Linear Algebra*, Prentice Hall.
4. K. Hoffman and R. Kunze (1989). *Linear Algebra*, 2nd Edition, Prentice-Hall of India.
5. S. Lang, (1989). *Linear Algebra*, Undergraduate Texts in Mathematics, Springer-Verlag, New York.
6. Vivek Sahai and Vikas Bist, (2013). *Linear Algebra*, 2nd Ed., Narosa Publishing house.
7. P. Lax, John Wiley & Sons (1997). *Linear Algebra*, New York. Indian Ed.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	-	1	1	2	2	2	2	3
CO2	2	2	2	2	2	2	2	-	-	2	1	2	2
CO3	3	2	3	3	1	-	-	2	2	2	2	2	2
CO4	2	3	3	2	2	2	2	1	2	3	3	2	3
Average	**2.2**	**2.5**	**2.7**	**2.25**	**1.7**	**2**	**1.6**	**1.2**	**2**	**2.2**	**2**	**2**	**2.5**

8. The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Calculus
Course Code: B610102
Semester 1st

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Recall the idea of derivative, rules of differentiation, test for concavity and convexity and understand the concept of p-r equation.
CO2	Demonstrate the concepts of curvature, radius of curvature, center of curvature and apply the concepts to solve problems.
CO3	Analyze the rules of identifying asymptotes, employ the same to find quadrature, length of an arc, Improper integrals and their convergence such as Comparison tests, Absolute and conditional convergence, Abel's and Dirichlet's tests.
CO4	Explain the hyperbolic functions and compare it with circular functions, trigonometric functions, inverse trigonometric functions and their applications.

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Successive differentiation, Asymptotes, Multiple points, Tests for concavity and convexity, points of inflexion, Tracing of curves in Cartesian,.Curvature, radius of curvature, centre of curvature.

Unit-2

Integration of hyperbolic and inverse hyperbolic functions, Reduction Formulae, application of definite integral to find quadrature, length of an arc.

Unit- 3

Improper integrals and their convergence, Comparison tests, Absolute and conditional convergence, Abel's and Dirichlet's tests,

Unit-4

Limits of sequence of numbers.Theorems for calculating limits of sequences, Infinite Series, Bounded and Monotonic sequences, Cauchys convergence criterion.Series of non-negative terms.Comparison tests.Cauchys' Integral test.Ratio tests. Alternating series. Absolute and conditional convergence. Lebnitz Theorem, Convergence of Taylor Series, Error Estimates. Applications of Power Series.

Reference books:

1. George B. Thomas, Maurice D. Weir and Joel R. Hass, (2014). *Thomas'Calculus*, 12thEd., Pearson Education, New Delhi,
2. Joseph L. Taylor, (2012). *Foundations of Analysis*, Pure and Applied Undergraduate Texts, 18, American Mathematical Society, Providence, RI,
3. Shanti Narayan, (2001). *Integral Calculus*, S. Chand and Company Ltd.
4. M.J. Strauss, G.L. Bradley and K. J. Smith, (2007). *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi,
5. R. Courant and F. John, (1989). *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	2	2	2	2	-	3	3
CO2	2	2	3	2	1	2	2	1	2	3	3	3	2
CO3	2	3	2	2	2	-	-	2	2	3	3	2	3
CO4	2	3	2	2	2	2	-	-	-	2	2	3	3
Average	**2.2**	**2.5**	**2.2**	**2**	**1.5**	**1.6**	**2**	**1.6**	**2**	**2.5**	**2.6**	**2.7**	**2.7**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Coordinate Geometry
Course Code: A610103
Semester 1st

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Describe the properties, equations, axes, latus rectum, pole, polar, Sub tangents, Subnormal and geometrical properties of parabola, ellipse and hyperbola.
CO2	Find the angle between planes, Bisector planes, Perpendicular distance from a point to a plane, Image of a line on a plane, Intersection of two lines
CO3	Draw the angle between planes, Bisector planes, Perpendicular distance from a point to a plane, Image of a line on a plane, Intersection of two lines
CO4	Demonstrate the properties, equations, axes, latus rectum, pole, polar, Sub tangents, Subnormal and geometrical properties of ellipse.
CO5	Clarify the properties, equations, axes, latus rectum, pole, polar, Sub tangents, Subnormal and geometrical properties of hyperbola.

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Circle: General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t. circle, radical axis, coaxial family of circles, limiting points.

Unit-2

Parabola: Pole and polar, pair of tangents from a point, chord of contact, equation of chord in terms of midpoints and diameter of conic, Sub tangent and Subnormal and its geometrical properties.

Unit-3

Ellipse: Properties of ellipse, parametric representation of ellipse, tangents, normals, equation of chord joining two points on ellipse. Director circle of ellipse, chord of contact, conjugate lines and conjugate diameter, Conormal Points and its geometrical properties.

Unit-4

Hyperbola: Properties of hyperbola, fundamental rectangle, parametric representation of hyperbola, asymptotes of hyperbola, Conjugate hyperbola, rectangular hyperbola, tangents and normals.

Reference Books:-

1. Loney, S. L. (1897). *The elements of coordinate geometry*. Macmillan and Company.
2. Jain,P.K. And Ahmad,K.(1994). *A Text Book of Analytical Geometry of two Dimensions*, Wiley Eastern Ltd.
3. Bell,R. J.T. (1994) . *Elementary Treatise on Coordinate Geometry of Three Dimesions*, Macmillan India Ltd.,
4. R. J.T. Bell (2016). *Elementary Treatise on Coordinate Geometry of Three Dimesions*,
5. Zafar Ahsan :(2018). *Text Book of Differential Equations and their Applications*, Prentice Hall of India.
6. Khalil Ahmad :(2012). *Text Book of Differential Equations*, World Education Publishers.
7. J. P. Mohindru, Mrs. Usha Gupta & A. S. Dogra (2004). *New Pattern Vector Algebra and Geometry*, International Publishers, New Edition

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	1	2	-	2	2	2	2	2
CO2	3	3	3	2	2	1	-	1	2	3	3	3	3
CO3	2	3	3	2	2	2	1	-	1	2	2	3	2
CO4	2	3	2	3	1	-	2	2	2	3	2	1	3
CO5	3	2	2	2	2	2	1	2	-	3	2	2	2

Average	**2.4**	**2.6**	**2.4**	**2.4**	**1.8**	**1.5**	**1.5**	**1.6**	**2.2**	**2.6**	**2.2**	**2.2**	**2.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Electricity And Magnetism-I
Course Code: B610104
Semester: 1st

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.
CO 2	Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.
CO 3	Analyze different problems in electromagnetism using mathematical methods involving vectors and simple differential and integral calculus, both analytically and numerically
CO 4	Have a rudimentary grasp on how experimental equipment related to electricity and magnetism can be used
CO 5	Design experiments and acquire data in order to explore physical principles, effectively communicate results, and critically evaluate related scientific studies.

Course Contents

SECTION -A

Vector calculus : Basic ideas of Vector Calculus, Scalar & vector fields, Gradient of a vector field, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, combination of grad, div & curl, Gradient, Divergence, curl and their physical significance, Stroke's theorem, Gauss's divergence theorem.

SECTION-B

Electrostatics : Coulomb's Law for point charges and continuous distribution of charges, electric field due to dipole, line charge, ring and sheet of charge. Electric field lines, Gauss's Law and its differential form.

SECTION -C

Electric Potential : Potential as line integral of field, potential difference, Gradient of a scalar function, Derivation of the field from the potential, potential of a charge distribution, Uniformly charged disc. Force on a surface charge, energy associated with an electric field, Gauss's theorem and differential form of Gauss's law, Laplacian and Laplace's equation, Poisson's equation.

SECTION D

Magnetostatics : Brief overview of Magnetic fields and forces, magnetic force on a current carrying wire. Torque on a current loop, Biot-Savartlaw .Field due to infinite wire carrying steady current, field of rings and coilsMagnetic field due to a solenoid, Force on parallel current carrying wires.Ampere's circuital law and its applications to infinite hollow cylinder, solenoid and toroid.Magnetic vector potential and its expression.

– Reference Books:-

1.Arthur F. Kipp(2005), *Fundamentals of Electricity and Magnetism*, Tata McGraw Hill

2. E.M. Purcell,(2008), *Electricity and Magnetism*, Berkeley Physics Course, Vol. II

3. David Griffith.(2010) ,*Introduction to Classical Electrodynamics*, Prentice Hall.

4. A.S. Mahajan& A.A. Rangwala,, (2002), *Electricity & Magnetism*, Tata McGraw Hill.

5. W.J. Duffin (2012), ,*Electricity & Magnetism*, 4th Edition, Tata McGraw Hill

6. Edward C. Jordan and K. G. Balmain,(2015), *EM Waves and Radiating Systems*, Prentice Hall.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	3	-	2	1	2	-	1	2	1	2
CO2	3	1	1	-	1	1	3	1	2	2	1	2	1
CO3	1	3	3	2	2	3	2	-	1	3	2	1	3
CO4	2	2	1	2	1	2	1	3	2	-	3	2	2

CO5	3	1	2	-	3	1	3	2	3	1	2	1	3
Average	**2**	**1.8**	**2**	**1.7**	**1.7**	**1.8**	**2**	**2.5**	**2**	**1.7**	**2**	**1.4**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Mechanics
Course Code: A610105
Semester: 1st

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Define the various coordinate systems, its applications, Michelson Morley exp, Einstein's postulates of theory of relativity
CO 2	Demonstrate the fundamental forces of nature, concept of centre mass, central forces and the motion of particle under central force and to determine the turning points of orbit.
CO 3	Determine the phenomena of collisions and idea about center of mass and laboratory frames and their correlation.
CO 4	Derive the frames of reference, coriolis forces and its applications and effect of rotation of earth on gravity
CO 5	Builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering.

Course Contents

SECTION–A

Co-ordinate System : Cartesian and spherical polar co–ordinate systems, area, volume, velocity and Acceleration in these systems. Solid angle, Relationship of conservation laws and symmetries of space and time.

SECTION–B

Inverse Square Law Forces : Central forces, Equation of motion under central force , Force between a Point Mass and Spherical shell. Force between a Point Mass and Solid Sphere, Gravitational and Electrostatic self-energy. Gravitational energy of the Galaxy and of uniform sphere; Orbits, equation of orbit, turning points, eccentricity. Two-body problem - reduced mass,.Kepler Laws.

SECTION–C

Frames of Reference : Inertial frame of reference. Galilean transformation and Invariance. Non Inertial frames and fictitious forces. Effect of rotation of earth on 'g'. Effects of centrifugal and Coriolis forces produced as a result of earth's rotation. Foucault's pendulum and its equation of motion

SECTION–D

Elastic and Inelastic Scattering : Types of Scattering and conservation laws, Laboratory and centre of mass system equivalent one body problem. Elastic collision in Lab. and C.M. systems, velocities, angles, and energies, cross section of elastic scattering, Rutherford scattering.

— Reference Books:-

1. Berkeley, *Mechanics*, Vol. I, C. Kittle.
2. H.S. Hans & S.P. Puri (2003), *Mechanics*. Tata McGraw-Hill Education.
3. Daniel Kleppner& Robert J. Kolenkow,*An Introduction to Machines* Tata McGraw-Hill.
4. R.G. Takwale& P.S. Puranik (2000), ,*Introduction of Classical Mechanics* Tata McGraw-Hill.
5. R.H. Good (1974) ,*Basic Concepts of Relativity*, East-West Press, New Delhi.
6. S.P. Puri (1972) ,*Special Theory of Relativity,*Asia Publishing House, Bombay.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	2	2	3	1	2	-	2
CO2	3	3	1	-	1	1	3	1	-	2	1	2	1
CO3	3	1	3	2	2	3	2	-	1	3	2	1	3
CO4	2	3	1	2	-	2	1	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	1	3	-	2	3	3
Average	**2.4**	**2**	**2**	**2**	**2.25**	**2**	**2.2**	**1.5**	**2.25**	**1.7**	**2**	**2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Waves and Oscillations-I
Course Code: A610106
Semester: 1st **L T P**
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Demonstrate the different types of the waves and their nature, electromagnetic waves & its spectrum.
CO 2	Differentiate periodic motions & simple harmonic motions with examples like Torsion pendulum, Compound Pendulum, Damped Simple harmonic motion, Electrical Oscillations.
CO 3	Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator in both time and frequency domains
CO 4	Deliver the general equation of wave motion in general and TM waves in stretched strings and longitudinal waves in gases
CO 5	Explain how to skillfully perform experiments of wave related phenomena, for example in the area of mechanical springs, diffraction, standing mechanical waves, AC circuits etc.

Course Contents

SECTION-A

Simple Harmonic Free Vibrations: Oscillations, Simple harmonic motion, Equation of SHM, Velocity and acceleration of SHM, energy of a SHO, The force of SHM, Differential equation and solution of SHM .

SECTION-B

SHO- applications : Compound pendulum, Electrical Oscillations, Torsion Pendulum, Transverse Vibrations of a mass on a string, composition of two perpendicular SHMs of same period, Anharmonic Oscillations.

SECTION-C

Damped Simple Harmonic Vibrations : Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping.

SECTION-D

Waves in Physical Media : Types of waves, Transverse and longitudinal waves, wave length, period, angular frequency, Wave motion in one dimension, Transverse and longitudinal waves, progressive harmonic waves and their energy, Transverse waves on a string, longitudinal waves on a rod, characteristic impedance of a string, waves in an absorbing medium, spherical waves.

Reference Books:-

1. S.P. Puri,, (2005), *Text Book of Vibrations and Waves*, Macmillan India Ltd.
2. H.J. Pain, ELBS & John Wiley,*(2012), Physics of Vibrations and Waves*, London.
3. Edward C. Jordan and K.G. Balmain,*(2013), EM Waves and Radiating Systems*, Prentice Hall.
4. A.P. French,(2008), *Vibrations and Waves*, Arnold Heinemann India, New Delhi.
5. P.K. Ghosh,(2018), *The Mathematics of Waves and Vibrations*, McMillan India.
6. N. Subrahmanayam& B. Lal,(2004). *Waves and Oscillations*, Vikas Pub., Delhi.

The mapping of PO/PSO/CO attainment is as follows:-

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	2	2	3	1	2	-	2

CO2	3	3	1	-	1	1	3	1	-	2	1	2	1
CO3	3	1	3	2	2	3	2	-	1	3	2	1	3
CO4	2	3	1	2	-	2	1	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	1	3	-	2	3	3
Average	**2.4**	**2**	**2**	**2**	**2.25**	**2**	**2.2**	**1.5**	**2.25**	**1.7**	**2**	**2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: INORGANIC CHEMISTRY - I

Course Code: A610107

Semester: 1st

Credits: 02

L T P

2 0 0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statements
CO1	Predict physical and electronic properties of atoms using current models.
CO2	Describe the physical and electronic properties of solid state materials.
CO3	Understand the basic principles and topics relevant to the field of inorganic chemistry.
CO4	Help in simulated modeling of matter fabricated at Nano levels.
CO5	Analyze electron gain enthalpy, trends of electron gain enthalpy

Course Content

1. **Atomic Structure:**

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of, Ψ and Ψ 2, quantum numbers, radial and angular wave functions and probability distribution curve, shapes of s, p, d orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions

2. Chemistry of Noble gases:-

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

3. Chemical Bonding – I:-

Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF2, BF3, CH4, PF 5, SF 6, IF 7, Sncl2, XeF4, BF4, PF 6-, SnCl6.

Section - B

4. Chemical Bonding – II :-Covalent Bond: Valence shell electron pair repulsion (VSEPR) theory to NH3, H3O+, SF4, CIF3, ICI2, and H2O. MO theory, homo nuclear (elements andions of 1st and 2nd row), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes) percentage ionic character from dipole moment and electro negativity difference

5. IonicSolids:-

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurzite, CaF2, and anti-fluorite), radius ratio rule and coordination number, Limitation 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, Fagan’s rule. Metallic bond-free electron, valence bond and bond theories

6. Weak Interactions:-

Hydrogen bonding, van der Walls forces

Reference Books:-

1. Singh, M. S. (2004). *Advanced inorganic chemistry: reactions and mechanisms*. Pearson Education India.
2. Finer, I. L. (1975). *Inorganic Chemistry: Volume 2: Stereochemistry and the Chemistry of Natural Products*. Pearson Education.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	-	3	3	2	2	3	-	2	1	2
CO2	3	3	1	3	1	1	3	1	2	2	1	2	1
CO3	3	1	3	2	2	3	2	-	1	3	2	1	3
CO4	2	3	1	2	-	2	1	2	2	2	3	-	2
CO5	3	1	2	3	3	1	3	1	-	1	2	3	3
Average	2.4	2	2	2.5	2	2	2.2	1.7	2	2	2	1.7	2.2

The correlation levels are: “1” – Low Correlation, “2” – Medium Correlation, “3” – High Correlation and “-” indicates there is no correlation.

Course Name: ORGANIC CHEMISTRY - I

Course Code: 610108

Semester: 1

Credits: 02 **L T P**

2 0 0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statements
CO1	Describe the need of studying hybridization and its relevance to the organic molecules
CO2	Predict about the various shapes of organic molecules.
CO3	Demonstrate the physical properties of organic molecules.
CO4	Analyze and reproduce accepted mechanisms of organic reactions including all intermediates and resonance structures.
CO5	Derive the theory of strain less rings in case of cyclopropane ring.

COURSE CONTENT

Section-A

1. Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Walls interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

2 . Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with half- headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents of organic reaction, Energy considerations, Reactive intermediates-bocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.Methods of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo-chemical studies)

Section – B

3. Alkanes

Isomerism in alkanes, sources, methods offormation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

4. Cycloalkanes

Cycloalkanes--nomenclature, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.

Reference Books:

3. Morrison, R. T., & Boyd, R. N. (2012). Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.
4. Singh, M. S. (2004). *Advanced organic chemistry: reactions and mechanisms*. Pearson Education India.
5. Finer, I. L. (1975). *Organic Chemistry: Volume 2: Stereochemistry and the Chemistry of Natural Products*. Pearson Education.
6. Eliel, E. L., & Wile, S. H. (1994). *Stereochemistry of organic compounds*. John Wiley & Sons.
7. Kelsi, P. S. (2007). *Spectroscopy of organic compounds*. New age international.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	-	3	1	-	3	1	2	3	2
CO2	3	2	1	3	1	1	3	1	2	2	1	2	1
CO3	3	1	3	2	2	3	1	3	-	3	2	1	3
CO4	2	3	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	1	3	-	2	1	3
Average	2.4	1.8	2	2.2	1.7	2	1.8	1.7	2	2	2	1.8	2.2

The correlation levels are: “1” – Low Correlation, “2” – Medium Correlation, “3” – High Correlation and “-” indicates there is no correlation.

Course Name: PHYSICAL CHEMISTRY – I

Course Code: 610109

Semester: 1

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statements
CO1	Recognize the different states of matter.
CO2	Differentiate the real and ideal gases on the basis of states of matter.
CO3	Demonstrate the kinetic the of gases and its practical usage in day to day life.
CO4	Explain about the inter conversion of matter.
CO5	Help in explaining states of matter necessary for industrial purposes.

COURSE CONTENT

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

Gaseous State

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases (based on Joule-Thomsoneffect).

Section - B

Physical Properties and Molecular Structure

Optical activity, polarization-(Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment.Induced dipole moment, measurement of dipole moment temperature method and ractivity method.Dipole moment and structure of molecules, magnetic properties- paramagnetism, diamagnetism and ferromagnetism.

Reference Books:

1. Peter Atkins, P., & De Paula, J. (2014). *Atkins' physical chemistry*. OUP Oxford.
2. Martin, W. R., Davidson, A. S., & Ball, D. W. (2016). *Journal of Chemical Education*.
3. Castellan, G. W. (1998). *Fisicoquímica*. Pearson Educación.
4. Mortimer, R. G. (1999). *Mathematics for physical chemistry*. Academic Press.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	2	-	3	-	2	1	2
CO2	3	3	1	-	1	1	3	1	2	2	1	2	1
CO3	3	1	3	2	2	3	2	3	1	3	2	1	3
CO4	2	3	1	2	1	2	1	2	-	2	3	2	2
CO5	3	1	2	3	-	1	3	1	3	1	2	3	3
Average	2.4	2	2	2	1.5	2	2.2	1.7	2.2	2	2	1.8	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Physics –I Lab

Course Code- 610110
Semester: 1

Credits: 02

L	T	P
0	0	4

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Demonstrate conceptual understanding of fundamental physics principles.
CO2	Communicate physics reasoning in oral and in written form.
CO3	Solve physics problems use qualitative and quantitative reasoning including sophisticated mathematical techniques.
CO4	Use experimental, conceptual and theoretical methods
CO5	Conduct independent research or work successfully in a technical position

COURSE CONTENT:

1. Analysis of experimental data by:

   i) Fitting of given data to a straight line.

   ii) Calculation of probable error.

2. To study the magnetic field of a circular coil carrying current.

3. To find out polarizability of a dielectric substance.

4. To study the laser beam characteristics like; wave length using diffraction grating aperture &divergence.

5. To study laser interference using Michelson's Interferometer.
6. Study of diffraction using laser beam and thus to determine the grating element.
7. To determine numerical aperture of an optical fibre.
8. To determine attenuation & propagation losses in optical fibres.
9. To find out the frequency of AC mains using electric-vibrator.
10. To study B-H curve using CRO.
11. To find the value of gravity using simple pendulum.
12. To study one-dimensional collision using two hanging spheres of different materials.

Note: Each student is required to perform at least ten experiments

Reference Books:-

1. C.L. Arora ,(2010), *Practical Physics*, S. Chand &Co.
2. R.S. Sirohi ,(2012), *Practical Physics*, , WileyEastern.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	2	3	-	2	3	2
CO2	3	2	-	3	1	1	3	-	2	2	1	2	1
CO3	3	1	3	2	2	3	1	3	1	3	2	-	3
CO4	2	3	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	-	1	3	1	-	1	2	1	3
Average	**2.4**	**1.8**	**2.2**	**1.8**	**1.7**	**2**	**1.8**	**2**	**2**	**2**	**2**	**2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation. **Course Name:**

Course Name- Chemistry – I Lab
Course Code: 610111

Semester: 1st

-L T P

Credits:01 **2 0 0**

Course Outcomes: On successful completion of this course, the students will able to:

CO	Statement
CO1	Express historical evolution of economics and its important in life.
CO2	Understand current issues and trends related to teaching of Flow come.
CO3	Proficiently use the various skills and techniques and strategies for teaching of economics.
CO4	Discuss unit plans and lesson plans on various topics present them effectively.

COURSE CONTENT

1. Determination of melting point of organic compounds.
2. .Determination of boiling point of an organic compound.
3. Distinguish between aldehyde and ketones bytollen's reagent.
4. .Crystalisation of phthalic acid from hot water.
5. Preparation of iodoform from ethanol or acetone
6. Detection of functional groups.
7. .Distinguish between aliphatic and aromatic compounds.
8. Determination of Viscosity and surface tension of pure Liquids.
9. To study the effect of acid strength on hydrolysis of ester.
10. Inorganic Qualitative Analysis.

Reference Books:

1. Basseff, R.C.Dennery, G.H. Jeffery and J. Mendham,ELBS. (2018) *Vogel's Qualitative Inorganic Analysis*, revised, Svehla, Orient Longman.
2. Basseff, R.C.Dennery, G.H. Jeffery and J. Mendham,ELBS. (2012), *Vogel's Textbook of Quantitative Inorganic Analysis* (revised), .
3. W.w. Scott (2015), *Standard Methods of Chemical Analysis*, the Technical Press.
4. W.G. Palmer , *(2013), Experimental Inorganic Chemistry:*,Cambridge.
5. W.G. Palmer ,*(2015) Handbook of Preparative Inorganic Chemistry.* Vol. I & II, Brauer,AcademicPress.

The mapping of PO/PSO/CO attainment is as follows:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PSO1	PSO2
CO 1	2	1	1	2	1	3	2	2	1	2	1	2
CO 2	1	2	1	3	1	2	1	1	2	3	2	1
CO 3	2	3	2	1	3	1	2	3	1	2	3	1
CO 4	3	1	2	1	2	1	2	3	2	1	2	2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name - History of Punjab-I
Course Code -610112
Sem- 1st

Total Credits-2

L T P
2 0 0

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Enhance the knowledge of students about the Sikh history of Punjab from 1469-1606.
CO2	Analyze the relation of the past with the present situations.
CO3	Get prepared for the various competitive exams.
CO4	Develop analytical skills among them.

2 0 0

UNIT-I

- Society in the Punjab during the Afghan rule.

- The Punjab under the Great Mughals.
- Salient features of the Bhakti movement and Sufism in the Punjab.
- Guru Nanak : His teachings; concept of Langar and Sangat.
- Development of Sikhism (1539-1581) : Contributions of Guru Angad Dev, Guru Amar Das and Guru Ram Das for the development of Sikhism.
- Transformation of Sikhism : Compilation of Adi-Granth; martyrdom of Guru Arjan Dev;
- Guru Hargobind's New Policy.

UNIT-II

- Martyrdom of Guru Tegh Bahadur; foundation of the Khalsa by Guru Gobind Singh.
- Banda Bahadur and his achievements; Sikh Struggle for sovereignty from 1716 to 1765;
- role of Dal Khalsa, Rakhi, Gurmata and Misls.
- Ranjit Singh's rise to power; civil and military administrations; relations with the British.
- Social change with special reference to the position of women.
- New developments in language, literature, architecture in the Punjab during the Medieval Period.
- Famous Folk tales of Medieval Punjab.

Suggested Readings :

1. Singh, Kirpal, "*History and Culture of the Punjab, Part-II (Medieval Period)"*, Publication Bureau, Punjabi University, Patiala, 1990 (3rd edn.).
2. Grewal, J.S., "*The Sikhs of the Punjab*, The New Cambridge University History of India, Orient Longman, Hyderabad, 1990.
3. Singh, Khushwant, "*A History of the Sikhs*, Vol. I : 1469-1839, Oxford University Press, Delhi, 1991.
4. Singh, Fauja (ed.), "*History of the Punjab*, Vol. III, Punjabi University, Patiala, 1972.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	2	2	-	2	2	2	2	3
CO2	2	3	2	3	2	1	-	2	-	3	2	2	2
CO3	3	2	2	2	2	-	2	-	2	2	3	2	3
CO4	2	2	2	2	2	2	2	2	1	3	2	-	2
Average	**2.2**	**2.2**	**2**	**2.2**	**2**	**1.6**	**2**	**2**	**1.6**	**2.5**	**1.7**	**2**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Differential Equations
Course Code: A610201
Semester 2nd

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Demonstrate the methods of forming and solving partial differential equations and Solve linear differential equations with constant and variable coefficients
CO2	Distinguish linear and non- linear differential equations, ordinary and partial differential equations that helps to develop problem- solving skills for solving various types of differential equations.
CO3	Find Particular integral of the forms of sin ax and cos ax, Homogeneous linear equations and Linear differential equations of second order,
CO4	Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients.

Course Content

Credits 03 **L T P**
3 0

Course Contents
Unit I

Formulation of differential equations, Order and degree of a differential equation, equations of first order and first degree, solutions of equations in which variables are separable, Homogeneous equations, Linear equations and Bernoulli equations, Exact differential equations, integrating factors, Change of variables.

Unit - II

Equations of the first order and higher degree, Equations solvable for *p, y* and *x*, Clairaut equation, Lagrange's equation, Power series method, Bessel and Legendre equations

Unit III

Linear differential equations with constant coefficient, Complementary function and particular integral. Particular integral of the forms ,sinax, cosaxand , Homogeneous linear equations.

Unit - IV

Linear differential equations of second order, Complete solution in terms of known integral belonging to the complementary function, Normal form, Change of independent variable, Method of undetermined coefficients, Method of variation of parameters, Simultaneous equations with constant coefficients, Simultaneous equations of form .

Reference Books:

1. Earl D. Rainville and P. E. Benediet, (1989.). *Elementary differential equations*, Seventhedition, Macmillian, Publishing Company,
2. Edwards,C. H. And Penny,D. E. (2005). *Differential Equations and Boundary Value Problems: Computing and Modelling*, Pearson education, India.
3. C.H. Edwards's and D.E. Penny, (2005). *Differential Equations and Boundary Value problems Computing and Modeling*, Pearson Education India,
4. S.L. Ross, (2004). *Differential Equations*, 3rd Ed., John Wiley and Sons, India,
5. MarthaL Abell,JamesP Braselton, (2004). Differential equations with mathematica,3rd Ed., Elsevier Academic Press,
6. Khalil, A. (2012). *Text Book of Differential Equations*, World Education Publishers.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	2	2	-	2	2	2	2	3
CO2	2	3	2	3	2	1	-	2	-	3	2	2	2
CO3	3	2	2	2	2	-	2	-	2	2	3	2	3
CO4	2	2	2	2	2	2	2	2	1	3	2	-	2
Average	**2.2**	**2.2**	**2**	**2.2**	**2**	**1.6**	**2**	**2**	**1.6**	**2.5**	**1.7**	**2**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Modern Algebra
Course Code: 610202
Semester 2nd

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements

CO1	Define Set, types and its operations, Binary relations like Reflexive, symmetric and transitive and furthermore, functions such as Injective, surjective and Bijective.
CO2	Test the homomorphic and isomorphic properties of groups and rings. Also, Explain the properties of groups, rings and different types of groups and rings
CO3	Develop proofs of results on Permutation groups ,Cyclic groups, Quotient group, Subgroups, subrings , quotient rings
CO4	Recall the definitions of groups, rings, functions and also examples of groups and rings and learn the concepts of ordered integral domains and Unique Factorization Domains

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Brief introduction: Sets, relations, functions; binary operations, Definition of groups with examples and its elementary properties, subgroups, order of an element of a group, cyclic groups, coset decomposition, Lagrange's theorem and its consequences, normal subgroup and factor groups. Various types of groups up to order 8. Group Homomorphism, Isomorphism, kernel of a homomorphism, The homomorphism theorems, The isomorphism theorems,Permutation groups, Even and odd permutations, Alternating groups,

Unit-2

Cayley'stheorem, and Regular permutation group. Definition and examples of Automorphism, inner automorphism, automorphism group of finite and infinite cyclic groups, conjugacy relation, normalizer and centre, External direct products, definition and examples of internal direct products.Class equation of a finite group and its applications, structure of finite abelian groups, Cauchy's theorem.Definition and example of Simple groups, non-simplicity test.

Unit-3

Rings and their elementary properties, Integral domain, Field. Subrings, Ideals and their properties, Field of quotients, Quotient rings. Homomorphism of rings and its properties, Kernel of a homomorphism, Natural homomorphism, Isomorphism and related theorems, Euclidian rings, unique factorization theorem.

Unit-4

Rings of polynomials over a field F, Properties of F[X], Rings of Gaussian integers, Rings of polynomials over rational field. Primitive polynomials and their properties.Gauss' Lemma and Einstein's criterion for irreducibility. Polynomial rings over commutative rings, unique factorization domain and its properties

Reference Books:

1. Edgar G. Goodaire and Michael M. Parmenter (2003). *Discrete Mathematics with Graph Theory*, 2nd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint.
2. Rudolf Lidl and Gunter Pilz, (2004). *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in

Mathematics, Springer (SIE), Indian reprint,

3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, (2004). *LinearAlgebra*,4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi,
4. Joseph A. Gallian, (1999). *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House New Delhi,
5. S. Lang, (2005). *Introduction to Linear Algebra*, 2nd Ed., Springer,.
6. Gilbert Strang, (2007). *Linear Algebra and its Applications*, Thomson
7. Davey and H.A. Priestley, (1990). *Introduction to Lattices and Order*, Cambridge University Press, Cambridge
8. Kenneth Hoffman, Ray Alden Kunze , (1971). *Linear Algebra*, 2nd Ed., Prentice-Hall of India Pvt. Ltd.,

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	2	2	2	2	3	3
CO2	2	3	2	3	2	2	1	2	-	3	2	1	2
CO3	3	2	2	2	2	-	-	-	2	2	2	2	3
CO4	2	2	2	2	2	2	2	2	2	3	-	3	2
Average	**2.2**	**2.2**	**2**	**2.2**	**1.7**	**1.5**	**1.6**	**2**	**2**	**2.5**	**2**	**2.2**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Probability and Statistics
Course Code: 610203
Semester 2nd

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Describe the Probability and its distributions such as binomial distributions, Poisson distribution and basic laws of total probability and compound probability in statistics.

CO2	Categorize appropriate sampling processes such as random sampling, large sample tests of means and proportion. *T-student*, (chi square) and *F* distributions (without derivation) and testing of hypothesis based on them. 2χ
CO3	Recall the methods of classifying and analyzing data relative to single variable and multiple variables.
CO4	Distinguish between the practical purposes of a large and a small sample and Understand that correlation coefficient is independent of the change of origin and scale

Course content

Credits 03 **L T P**
3 0 0

Unit-1

Sample space and events, algebra of events, axiomatic approaches, conditional probability, basic laws of total probability and compound probability, Byes' theorem, Independence.

Unit-2

Discrete and continuous random variables, mathematical expectation, variance, moment about a point, central moment, moment generating function, Binomial, Poisson, Normal and Rectangular distributions.

Unit-3

Two-dimensional random variables, joint distribution functions, marginal distributions, covariance, linear regression and correlation, rank correlation, least square method of fitting regression lines.

Unit-4

Sampling, random sampling, large sample tests of means and proportion. *t*-student, (chi square) and *F* distributions (without derivation) and testing of hypothesis based on them. 2χ

Reference Books

1. Irwin Miller and Marylees Miller,(1975).*John E. Freund's Mathematical Statistics with Applications*, Pearson Education.
2. Robert V. Hogg, Allen Craig Deceased and Joseph W. McKean,(2002). *Introduction to Mathematical Statistics*, Pearson Education
3. Sheldon M. Ross, (2009). *Introduction to probability and statistics for engineers and scientists*, Elsevier Academic Press.
4. Goon, A.M., Gupta and M.K., Das Gupta, (1991). *Fundamental of Statistics*. Vol 1. World , B. Press. Calcutta.
5. Chung, K.L. (1974). *A Course in Probability theory*. Linear Statistical Inference and its applications, Wistern.
6. Goon, A.M., Gupta, M.K. and Das Gupta, B. (1985). *An Outline of Statistical Theory*. Vol. I, , 3rd ed. World Press.

7. Bhat, B. R., Srivenkatraman, T., and Rao Madhava, K. S. (1997). *Statistics: A Beginner's Text*, Vol. I. New Age International (P) Ltd.
8. Croxton F.E., Cowden D. J., and Kelin, S (1982). *Applied General Statistics*, Prentice-Hall of India, 3rd Edition.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	1	2	2	2	1	2	3
CO2	2	2	3	3	2	2	2	-	-	3	2	1	2
CO3	2	3	2	2	2	1	2	1	2	2	1	3	3
CO4	2	3	2	3	2	-	-	2	2	3	3	2	2
Average	2.25	2.5	2.5	2.5	1.75	1.3	1.6	1.6	2	2.5	1.75	2	2.5

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Electricity and Magnetism-II
Course Code: A610204
Semester: 2nd

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Develop knowledge and understanding of the key principles and applications of Electromagnetic Theory
CO 2	Compare different types of magnetic materials ,their properties& applications in different fields in day to day life.
CO 3	Demonstrate electromagnetic induction & their applications in different electric substances like transformers LCR circuits etc.
CO 4	Classifycharged particle dynamics and radiation from localized time varying electromagnetic sources.
CO 5	Imparts the skill to explain the properties of light and radio waves; the magnetic fields produced by brain activity; the way a television tube works; the transparency of the cornea in your eye; and many other phenomena.

Course Contents

SECTION-A

Electric Fields in Matter : Dielectrics, Moments of a charge distribution, Potential and field of a dipole, Atomic and molecular dipoles, Induced dipole moments, Permanent dipole moments, electric field caused by polarized matter, field of a polarized sphere, dielectric sphere in a uniform field, Gauss's law and a dielectric medium, Electrical susceptibility and atomic polarizability.

SECTION-B

Field of Moving Charges:- Measurement of charge in motion, Electric field in different frames of references, Electric field due to moving charges, electric force in two internal frames, Interaction between moving charges.

SECTION-C

Magnetic Fields in Matter : Response of various substances to magnetic field, Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetic susceptibility.

SECTION-D

Electromagnetic theory: Faraday's Law and EM induction. Displacement current.Maxwell's equations. Mutual inductance and reciprocity theorem.Self inductance L for solenoid.Coupling of Electrical circuits.Analysis of LCR series and parallel resvonantcircuits.Q-factor.Power factor.

Reference Books:

1. E.M.Purcell (1965.), *Electricity and Magnetism*, McGraw-Hill ,Berkeley Physics Course.Vol.II
2. F.Kip, (1969), *Fundamentals of Electricity and Magnetism*, McGraw Hill
3. David Griffith,*Introduction to Classical Electrodynamics*, Prentice Hall of India, New Delhi.
4. Edward C.Jordan and K.G.Balmain,*EM Waves and Radiating Systems*, Prentice Hall of India, New Delhi.
5. A.S. Mahajan& A.A. Rangwala, *Electricity & Magnetism*, Tata McGraw Hill.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	-	1	3	3	1	2	3	-	2	3	2

CO2	3	2	1	3	-	1	3	-	2	2	1	2	1
CO3	3	1	3	2	2	3	1	3	1	3	2	1	3
CO4	2	3	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	1	-	1	2	1	3
Average	**2.4**	**1.8**	**1.7**	**2.2**	**2**	**2**	**1.8**	**2**	**2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Mechanics-II
Course Code: B610205
Semester: 2nd

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Compare inertial and non-inertial systems and essentials of special theory of relativity, Whichprovides intellectual food for students interested in theoretical studies.
CO 2	Analyze the effect of the accelerating and non-accelerating frames on the motion of body and effect of mechanical forces.
CO 3	Derive special relativistic effects and their effects on the mass and energy of a moving object.
CO 4	Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
CO 5	Explain special theory of relativity and apply its concepts in various fields of physics and engineering with dynamics also that involved in a rigid body.

Course Contents

Unit - I

Dynamics of rigid bodies: Equation of motion of a rigid body, moment of inertia, radius of gyration, theorems of parallel and perpendicular axes,Principle Exes and Euler's equations, Elementary Gyroscope, Symmetrical Top, moments of inertia of a ring, disc, rectangular beam, hollow and solid cylinders, spherical shell, solid and hollow spheres, moment of inertia of fly wheel, compound pendulum.

Unit - II

Galilean Transformation: Frame of reference, limitation of Newton's law of motion, Inertial reference frames, absolute and relative accelerations and velocity, Galilean Transformation, Conservation of Momentum, Fictitious Forces, Collisions, Velocity and Acceleration in Rotating coordinate systems.

Unit - III

Lorentz Transformations: Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations, Simultaneity and causality in relativity. Length contraction, Time dilation, Velocity Transformation, Twin Paradox,Variation of mass with velocity,Transformation of relativistic momentum and energy, relation between relativistic momentum and energy, Space-like and time-like intervals, Aberration of light, Doppler effect

Unit - IV

Conservation Laws: Conservation of Energy, Conservative forces, Internal forces and conservation of linear momentum, Centre of mass, systems with variable mass, Space-Vehicle Problem. Conservation of Angular Momentum, Internal torques, Angular Momentum about the Centre of mass, Rotational invariance, Shape of Galaxy.

Reference Books:

1. Herbert Goldstein (1980), *Classical Mechanics*, Pearson; 2nd edition.
2. R. Resnick and D. Halliday (1990), *Physics*, vol 1, Wiley 4th Ed.
3. Marion &Thornton(1970), *Classical Dynamics of Particles and Systems*, Academic Press Inc; 2nd Revised edition
4. A. Fetter and J. Walecka(2003) , *Theoretical mechanics of particles and continua*, Dover Pubns.
5. Kiran Gupta (1988), *Classical Mechanics of Particles and Rigid Bodies*, John Wiley & Sons.
6. Richard. P Feynman & Matheww Sands, *The Feynman Lectures*, Pearson Education; First edition
7. Antonio Fasano, *Analytical Mechanics*, OUP Oxford
8. R. Douglas Gregory, *Classical Mechanics*, An Undergraduate Text

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	-	1	3	3	1	2	3	-	2	3	2
CO2	3	2	1	3	-	1	3	-	2	2	1	2	1
CO3	3	1	3	2	2	3	1	3	1	3	2	1	3
CO4	2	3	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	1	-	1	2	1	3

Average	**2.4**	**1.8**	**1.7**	**2.2**	**2**	**2**	**1.8**	**2**	**2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Waves and Oscillations-II
Course Code: A610206
Semester: 2nd

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO1	Explain about the various branches of science and engineering, especially in the field of photonic engineering.
CO2	Demonstrate the role of the wave equation and appreciate the universal nature of wave motion
CO3	Describe and analyze electromagnetic wave propagation in free-space, Reflection and transmission of EM waves in boundary conditions and from Surface
CO4	Analyze the fundamentals of harmonic oscillator model, including damped and forced oscillators and grasp the significance of terms like quality factor and damping coefficient
CO5	Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering, interpretation Maxwell's equations

Course Contents

SECTION-A

Forced Vibrations and Resonance: A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force. Q-factor of a forced oscillator, Electrical, nuclear and nuclear-magnetic resonances.

SECTION-B

Coupled Oscillations: Stiffness coupled oscillators, Normal coordinates and modes of vibrations. Normal frequencies, Forced vibrations and resonance for coupled oscillators, Masses on string-coupled oscillators.

SECTION-C

Waves in Physical Media: Reflection and Transmission of waves at boundary. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length.

SECTION D

Electromagnetic Waves : E.M. waves and wave equation in a medium having finite permeability and permitivity but with conductivity $\sigma = 0$, EM waves in a conducting medium
and skin depth.

Reference Books :

1. S.P. Puri (2001), ,*Text Book of Vibrations and Waves,* Macmillan India Ltd.
2. H.J. Pain, ELBS & John Wiley,(2009), *Physics of Vibrations and Waves*, London.
3. Edward C. Jordan and K.G. Balmain,(2010) *EM Waves and Radiating Systems*, Prentice Hall.
4. A.P. French, (2012), *Vibrations and Waves*, (Arnold Heinemann India, New Delhi.
5. P.K. Ghosh,(2015), *The Mathematics of Waves and Vibrations*, Mcmillan India.
6. N. Subrahmanayam& B. Lal, (2014), *Waves and Oscillations*, Vikas Pub., Delhi.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	-	3	3	1	-	3	-	2	3	2
CO2	3	2	1	3	1	1	3	1	2	2	1	2	1
CO3	3	1	3	2	2	3	1	3	1	3	2	1	3
CO4	2	3	1	2	-	2	1	2	-	2	3	2	2
CO5	3	1	2	3	3	1	3	1	3	1	2	1	3
Average	**2.4**	**1.8**	**2**	**2.5**	**2.2**	**2**	**1.8**	**1.7**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Inorganic Chemistry- II

Course Code: 610207

Semester: 2

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Describe the importance of the Periodic Table of the Elements and its role in Organizing chemical information.
CO2	Provide an introduction about the behavior, description of the elements and to explain how the electronic properties affect reactivity, atomic size and other physical and chemical properties of the elements
CO3	Demonstrate the fundamental theory of nature at small scale, levels of atom and sub-atomic particles
CO4	Relate the structure of atoms and subatomic particles
CO5	Demonstrate the fundamental theory of nature at small scale, levels of atom and sub-atomic particles

COURSE CONTENT

Section - A

Periodic Properties Position of elements in the periodic table, effective nuclear charge and its calculations, Atomic and ionic radii, ionization energy, electron affinity and electro negativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviors.

S-Block Elements : Comparative study, diagonal relationships, salient features of hydrides,

solvation and complexation tendencies including their function in bio systems, an introduction to alkyls and arys.

Group No.13

Comparative study (including diagonal relationship) of groups 13 elements, hydrides of boron-diborane and higher boranes, borazine, borohydrides

Section – B

p – Block Elements

Comparative study (including diagonal relationship) of groups 14-l7 elements, compounds like hydrides, oxides, oxyacids and halides of groups 14-17; fullerenes, carbides, fluorocarbons, silicates (structural principle),

References Books:

1. Lee, J. D. (2008). *Concise inorganic chemistry*. John Wiley & Sons.
2. Douglas, B. E., McDaniel, D. H., & Alexander, J. J. (1994). *Concepts and models of inorganic chemistry* (Vol. 928). New York: Wiley.
3. Greenwood, N. N., & Earnshaw, A. (2012). *Chemistry of the Elements*. Elsevier.
4. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., & Grimes, R. (1988). *Advanced inorganic chemistry* (Vol. 6, p. 1455). New York: Wiley.
5. Rodgers, G. E. (2011). *Descriptive inorganic, coordination, and solid state chemistry*. Cengage Learning.
6. Miessler, G. L., & Tarr, D. A. (2004). Inorganic Chemistry. Pearson Education. *Upper Saddle River, NJ*.
7. Atkins, P., & Overton, T. (2010). *Shriver and Atkins' inorganic chemistry*. Oxford University Press, USA.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	2	3	-	2	3	2
CO2	3	2	1	3	-	1	3	1	2	2	1	2	1
CO3	3	1	-	2	2	3	2	3	1	3	2	3	3
CO4	2	3	1	2	1	2	1	2	2	2	3	2	2
CO5	3	1	2	-	3	1	3	1	-	1	2	1	3
Average	2.4	1.8	1.4	2.2	1.8	2	2	1.8	1.6	1.6	2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: ORGANIC CHEMISTRY - II

Course Code: 610208

Semester: 2

Credits :02 **L T P**

2 0 0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Demonstrate the physical properties of organic molecules.
CO2	Differentiate the aliphatic and aromatic compounds efficiently.
CO3	Derive the halides in terms of their preparation and general properties as Well
CO4	Enlighten relationship between acidity constant pk and an acid-base reaction.
CO5	Draw the structure of an organic molecule using substitutive and/or functional class IUPAC nomenclature

Course Content

Section-A

Nomenclature of benzene derivative, the aryl group, Aromatic nucleus and side chain. Structure of benzene: molecular formula vand Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: the Huckel rule, aromaticions.

Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes, Mechanism or nitration, halogenation, sulphonation, Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives Methods of formation and chemical reaction of alkylbenzenes

Section – B

Alkcnes

Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration, The Saytzeffrule, Hofmanr elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions Markownikoff's rule, hydroboration-oxidation, oxymercurationr eduction.

Section – C

Dienes And Alkynes

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization, Chemical reactions-I, 2 and l, 4 additions, Diels-Alder reaction

Nomenclature, structure and bonding in alkynes. Methods of formation, Chemical reactions of alkynes, acidityn of alkynes, Mechanism of electrophilic and nucleophilic metal-ammonia reductions, oxidation and polymerization

Section – D

Alkyl and aryl halides 9 Hrs.Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2and SN1 reactions with energy profilediagrams.

Methods of formation of aryl halides, nuclear and side chain reactions, The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions

Relative reactivities of alkyl halides vsallyl, vinyl and aryl halides.

Reference Books:

1. Morrison, R. T., & Boyd, R. N. (2012). *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd.).
2. Finar, I. L. (2007). *Organic Chemistry*, Vol-1, Dorling Kindersley (India) Pvt).
3. Solomons, T. G. (1980). *Organic Chemistry.* New York Chichester Brisbane Toronto.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	2	3	1	2	3	2
CO2	3	3	1	-	1	-	3	1	-	2	1	2	1

CO3	3	1	3	2	2	3	2	3	1	3	2	3	3
CO4	2	3	1	2	-	2	1	2	2	-	3	2	2
CO5	3	1	2	3	3	1	3	1	3	1	2	1	3
Average	2.4	2	2	2	2.2	2.2	2	1.8	2.2	1.7	2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHYSICAL CHEMISTRY – II

Course Code: 610209

Semester: 2nd

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will be able to::

CO	Statement
CO1	Describes the critical state, adapts critical state equation to the problems.
CO2	Calculate the temperature dependence of rate constants and relate this calculation to activation energy
CO3	Relate reaction kinetics to potential reactions mechanisms
CO4	Derive the colligative properties and their applications for binary solutions
CO5	Analyze the theories of chemical kinetics, effect of temperature on rate of reaction.

COURSE CONTENT

Section-A

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficients of Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing point,

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, Emulsifiers. Liquids in solids, (gels) classification, preparation and properties inhibition, General applications of colloids

Section – B

Chemical Kinetics

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. Radioactive decay as a first order phenomenon

Theories of chemical kinetics, effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis)

Surface Chemistry

Catalysis and general characteristics of catalytic reactions, Homogeneous catalysis, acid base catalysis and enzyme catalysis including their mechanisms, MichaelisMenten equation for enzyme catalysis and its mechanism

Reference Books:

1. Atkins, P., De Paula, J., & Friedman, R. (2014). *Physical chemistry: quanta, matter, and change*. Oxford University Press, USA.
2. Gladstone, S. (1951). *Textbook of physical chemistry*. Macmillan.
3. McQuarrie, D. A., & Simon, J. D. (1999). *Molecular thermodynamics*. Sterling Publishing Company.
4. Assael, M. J., Wakeham, W. A., Goodwin, A. R., Will, S., & Stamatoudis, M. (2011). *Commonly asked questions in thermodynamics*. CRC Press.
5. Acrivos, J. (1988). *Physical chemistry*, (Levine, Ira N)

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	-	1	3	3	1	-	3	1	2	3	2
CO2	3	3	1	3	1	2	3	1	3	2	1	2	1
CO3	3	1	3	2	2	3	2	3	-	3	2	3	3
CO4	2	3	1	2	1	2	1	2	2	-	3	2	2
CO5	3	1	2	-	3	3	3	1	3	1	2	2	3
Average	2.4	2	1.7	2	2	2.6	2	1.7	2.7	1.7	2	2.4	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Physics – II Lab

Course Code: 610210

Semester: 2nd

L T P

Credits:01 **2 0 0**

Course Outcomes: On successful completion of this course, the students will able to:

CO	Statement

CO1	Critically assess their current state of knowledge and expertise and develop, implement and refine a plan to acquire new knowledge for specific scientific goals and in pursuit of new intellectual interest
CO2	Apply the laws of physics To the problem
CO3	Apply conceptual understanding of the physics to general real-world situations.
CO4	Experience and understand basic physical fundamentals and the key vocabulary to describe them: kinematics, dynamics, work and energy, rotations, gravitation, heat and thermodynamics, fluids.
CO5	Participate in the methodology by performing laboratory exercises.

COURSE CONTENT

1. Familiarization of electronics component and equipments like C.R.O., FunctionGenerator and power supplies etc.
2. To study and verify the ohm'slaw.
3. To study the V-I characteristics of PN-Junction diode and determine static resistanceand dynamic resistance.
4. To plot lissajous figures and determine phase angle byCRO.
5. To find maximum, minimum and range of a given set ofnumbers.
6. To compile a frequency distribution and evaluate moments such as mean: standarddeviation etc.
7. To evaluate sum of finite series and the area under acurve.
8. To establish relationship between torque and angular acceleration using fly wheel andhence to find inertia offlywheel.
9. To check the losses of transformer using open circuit and short circuittest.
10. Study of R-L-C Seriescircuit.
11. Study of R-L-C parallelcircuit.
12. To verify Kirchhoff'sLaw.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PSO	PSO	PSO

										0	1	2	3
CO1	1	2	-	1	3	3	1	2	3	1	2	3	2
CO2	3	3	1	3	1	1	3	-	3	2	1	2	1
CO3	3	1	3	2	2	3	2	3	1	3	2	3	3
CO4	2	3	1	2	-	2	1	2	-	2	3	2	2
CO5	3	1	2	-	3	1	3	1	3	-	2	1	3
Average	**2.4**	**2**	**1.7**	**2**	**2.2**	**2**	**2**	**2**	**2.5**	**2**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: CHEMISTRY – II Lab

Course Code: 610211

Semester: 2nd

L T P

Credits:01 **2 0 0**

Course Outcomes: On successful completion of this course, the students will able to::

CO	**Statement**
CO1	Express historical evolution of economics and its important in life.
CO2	Understand current issues and trends related to teaching of Flow come.
CO3	Proficiently use the various skills and techniques and strategies for teaching of economics.
CO4	Discuss unit plans and lesson plans on various topics present them effectively.
CO5	Determine the viscosity and surface tension of C2H5oH and glycerin solution in water

COURSE CONTENT

Laboratory Techniques

Determination of melting points:

Naphthalene, 80-82^0. Benzoic acid, 121.5-122^0 Urea,

132.5-133^0, Succinic acid, 184.5-185^0.

Cinnamic acid, 132.5-133^0, Salicylic acid, 157.5-158^0.
Acetanilide, 113.5-114^0, m-Dinitrobenzene, 90^0. ρ-Dichlorobenzene, 52^0, Asprin, 135^0.

Determination of boiling points

Ethanol, 78^0, Cyclohexane, 81.4^0. Tolune, 110.6^0, Benzene, 80^0.

Crystallization

concept of induction of crystallization

Phthalic acid from hot water (using fluted filter paper and seamless funnel)
Acetanilide from boiling water

Naphthalene from ethanol
Benzoic acid from water

PhysicalChemistryExperiment 20 Marks

Chemical Kinetics

11. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at roomtemperature.
12. To study the effect of acid strength on the hydrolysis of anester.
13. Viscosity & Surface Tension of pureliquids.
14. To determine the viscosity and surface tension of C2H5oH and glycerin solution in water
15. Molecular weight determined by Partmethod.

Reference Books:

1. Basseff, R.C.Dennery, G.H. Jeffery and J. Mendham,ELBS. (2018) *Vogel's Qualitative Inorganic Analysis*, revised, Svehla, Orient Longman.
2. Basseff, R.C.Dennery, G.H. Jeffery and J. Mendham,ELBS. (2012), *Vogel's Textbook of Quantitative Inorganic Analysis* (revised), .
3. W.w. Scott (2015), *Standard Methods of Chemical Analysis*, the Technical Press.
4. W.G. Palmer , *(2013), Experimental Inorganic Chemistry:*,Cambridge.
5. W.G. Palmer ,*(2015) Handbook of Preparative Inorganic Chemistry.* Vol. I & II, Brauer,AcademicPress.

The mapping of PO/PSO/CO attainment is as follows:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PSO1	PSO2
CO 1	2	1	1	2	1	3	2	2	1	2	1	2
CO 2	1	2	1	3	1	2	1	1	2	3	2	1
CO 3	2	3	2	1	3	1	2	3	1	2	3	1
CO 4	3	1	2	1	2	1	2	3	2	1	2	2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name- History of Punjab-II
Course Code: 610212
Semester: 2nd

L	T	P
3	0	0

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Enhance the knowledge of students about the Sikh history of Punjab from 1469-1606.
CO2	Analyze the relation of the past with the present situations.
CO3	Get prepared for the various competitive exams.
CO4	Develop analytical skills among them.

1. Physical features of the Punjab and their impact on history.
2. Harappa Civilization: Antiquity, extent and important places, script, town planning. Political, social, economic and religious life of the Indus Valley people.
3. The Indo–Aryans: Original home and settlement in Punjab; Social, Religious and Economic life during the Rig Vedic Age;
4. The Indo–Aryans: Social, Religious and Economic life during later Vedic Age.

5. Teaching and impact of Buddhism in the Punjab.
6. Teaching and impact of Jainism in the Punjab.
7. Punjab under Chandra Gupta Maurya and Ashoka.
8. The Punjab under the Gupta Emperors.

Reference:-

1. L.M. Joshi (Ed.) *History and Culture of the Punjab*,(1989), Part–1, Patiala, (3rd Edition).
2. L.M. Joshi and Fauja Singh (Ed.)(1977) *History of Punjab*, Vol. 1, Patiala,.
3. Buddha Prakash,(1988*), Glimpses of Ancient Punjab*, Patiala.
4. B.N. Sharma,(1966), *Life in Northern India*, Delhi.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	-	1	3	3	1	2	3	1	2	3	2
CO2	3	3	1	3	1	1	3	-	3	2	1	2	1
CO3	3	1	3	2	2	3	2	3	1	3	2	3	3
CO4	2	3	1	2	-	2	1	2	-	2	3	2	2
CO5	3	1	2	-	3	1	3	1	3	-	2	1	3
Average	**2.4**	**2**	**1.7**	**2**	**2.2**	**2**	**2**	**2**	**2.5**	**2**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Advanced Calculus
Course Code: A610301
Semester 3rd

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Comprehend the concepts of completeness, continuity and discontinuity of metric spaces Differentiability of real-valued functions of two variables. Partial differentiation, Jacobians and their properties,
CO2	Differentiate continuous functions and uniform continuous functions and their completeness.

CO3	Restate Schwarz's & Young's theorems. Euler's theorem on homogenous functions. Taylor's theorem for functions two variables and error estimation
CO4	Analyze Greens Theorem in the Plane Parameterized Surface, Stokes Theorem, the Divergence Theorem, Applications of Green's, Stokes and Divergence theorem.

Course Contents

Unit - I

Limit and Continuity of Functions of several variables. Differentiability of real-valued functions of two variables. Partial differentiation, Jacobians and their properties, Schwarz's & Young's theorems.

Unit - II

Euler's theorem on homogenous functions. Taylor's theorem for functions two variables and error estimation. Maxima and Minima, Lagrange's multiplier method .Convergence of Taylor'sSeries.

Unit - III

Scalar and vector fields, differentiation of vectors, velocity and acceleration. Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to point functions and their products.

Unit - IV

Line, surface and volume integrals, Greens Theorem in the Plane Parameterized Surface, Stokes Theorem and the Divergence Theorem. Applications of Green's, Stoke's and Divergence theorem.

.**Reference books:**

1. G.B. Thomas and R.L. Finney, (2005). *Calculus,* 9th Ed., Pearson Education, Delhi,

2. M.J. Strauss, G.L. Bradley and K. J. Smith, (2007). *Calculus,* 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi,
3. H. Anton, I. Bivens and S. Davis, (2002). *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore,

4. R. Courant and F. John, (1989). *Introduction to Calculus and Analysis* (Volumes I & II), Springer- Verlag, New York, Inc.,
5. Khalil Ahmad: (1989). *Text Book of Differential Equations*, World Education Publishers.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	1	2	1	2	2	2	1	3
CO2	2	3	3	2	2	2	-	2	2	3	3	2	2
CO3	2	2	2	3	1	-	2	-	2	3	2	2	3
CO4	2	2	2	2	2	2	2	2	-	3	2	2	2
Average	**2.25**	**2.25**	**2.5**	**2.5**	**1.75**	**1.6**	**2**	**1.6**	**2**	**2.75**	**2.25**	**1.75**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Analysis –I
Course Code: A610302
Semester 3rd

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Explain the basic properties of Elementary Methods in Ordinary Differential Equations, Formation of a differential equation. Solutions: General, particular, and singular.
CO2	Compare the methods of forming and solving partial differential equations and Solve linear differential equations with constant and variable coefficients
CO3	Find Particular integral of the forms of sin ax and cos ax , Homogeneous linear equations and Linear differential equations of second order,
CO4	Use the basic properties of Laplace Transforms and Inverse Laplace Transform to find the solution of linear differential equations.

Course Contents

Unit - I

Elementary Methods in Ordinary Differential Equations,Formation of a differential equation. Solutions: General, particular, and singular. First order exact equations and integrating factors. Degree and order of

a differential equation, Equations of first order and first degree, Equations in which the variable are separable, Homogeneous equations, Linear equations and equations reducible to linear form.

Unit - II

Linear differential equations of second order, Transformation of the equation by changing — the dependent variable and the independent variable, Method of variation of parameters, Ordinary simultaneous differential equations.

Unit - III

Laplace transforms, Introduction to infinite integrals, Linearity of Laplace trans-forms. Existence theorem for Laplace transforms. Laplace transforms of derivatives and integrals, Applications of Laplace transforms.

Unit - IV

Inverse Laplace Transforms Shifting theorems, Differentiation and integration of transforms. Convolution theorem, Solution of integral equations and systems of differential equations using Laplace transforms.

REFERENCES BOOKS

1. Boyce and Diprima, (2008) *Elementary Differential Equations and Boundary Value Problems.*
2. Murray, D.(2006), *Introductory Course in Differential Equations*
3. Simmons, (2005) *Differential Equations.*
4. Iyenger, and Bali, (2016) *A Textbook of Engineering Mathematics.*
5. Ross, S.,(2016)*Differential Equations*
6. T. M. Apostol (1985) *Mathematical Analysis*, Narosa Publishing House, New Delhi.
7. R. R. Goldberg, (1970) *Real Analysis*, Oxford & IBH Publishing Co., New Delhi,.
8. D. Soma sundaram and B. Chaudhary,,(1977)*A First Course in Mathematical Analysis*, Narosa Publishing House, New Delhi
9. Shanti Narayan. (2005), *Course of Mathematical Analysis*, Chand & Co., New Delhi.
10. P. K. Jain and S. K. Kaushik,(2000)*An Introduction to Real Analysis*, S. Chand & Co., New Delhi
11. R.V. Churchill & J.W. Brown, (, 1990.)*Complex Variables and Applications*, 5th Edition, McGraw Hill, New York.
12. Shanti Narayan, (2005)*Theory of Functions of a Complex Variable*, S. Chand & Co., New De

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	1	1	2	1	2	1	2	3
CO2	2	3	2	2	2	1	2	2	2	3	2	3	2
CO3	3	2	3	3	2	2	2	-	1	3	3	2	3
CO4	2	3	3	2	2	-	-	2	-	2	2	2	3.

Average	**2.25**	**2.5**	**2.75**	**2.5**	**1.75**	**1.2**	**1.6**	**2**	**1.2**	**2.5**	**2**	**2.25**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Mechanics –I
Course Code: A610303
Semester 3rd

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Define Resultant, Component of a Force, Co planar forces, like and unlike parallel forces, Moment of a force and couple with example.
CO2	Prove the Parallelogram of Forces, Triangle of Forces, Converse of the Triangle of Forces, Polygon of Forces, Lami's Theorem, Varignon's theorem of moments.
CO3	Find the resultant of co planar couples, equilibrium of couples and the equation to the line of action of the resultant.
CO4	Explain Friction, Forces of Friction, Cone of Friction, Angle of Friction and Laws of friction.

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Statics: Basic notation, Newton Laws of motion, system of two forces, parallelogram law of forces, resultant of two collinear forces, resolution of forces, moment of a force, couple, theorem on moments of a couple,

Unit-2

Coplaner forces, resultant of three coplanar concurrent forces, theorem of resolved parts, resultant of two forces acting on a rigid body, Varignon's theorem, generalized theorem of moments.

Unit-3

Equilibrium of two concurrent forces, equilibrium condition for any number of coplanar concurrent forces, Lami's theorem. λ - μ theorem, theorems of moments, resultant of a force and a copule.

Unit-4

Dynamics : Motion in a straight line, Newton's law of motion, Motion on an inclined plane. Motion

under variable acceleration, Simple harmonic motion, Relative Motion, Projectiles, Work, Power, Energy

Reference Books:

1) S.L. Loney: (1947). *The elements of statics and dynamics*, 5th edition, Cambridge University Press.
2) Blanchard, F., Maass, A., & Nogueira, A. (Eds.). (2000). *Topics in symbolic dynamics and applications* (Vol. 279). Cambridge university press.
3) Weatherburn, C.E. (1924). *Advanced Vector Analysis*. G. Bell and Sons, Ltd...
4) Goldstein H., Poole, C. and Safko, J. (2002). *Classical Mechanics*. 3rd Edition, Addison Wesley.
5) Spiegel, M. Lipschutz, S and Spellman, D. (2009). *Vector Analysis*. Schaum Outline Series. McGraw Hill.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	1	2	1	2	2	2	1	3
CO2	2	3	3	2	2	2	-	2	2	3	3	2	2
CO3	2	2	2	3	1	-	2	-	2	3	2	2	3
CO4	2	2	2	2	2	2	2	2	-	3	2	2	2
Average	**2.25**	**2.25**	**2.5**	**2.5**	**1.75**	**1.6**	**2**	**1.6**	**2**	**2.75**	**2.25**	**1.75**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Statistical Physics and Thermodynamics-I

Course Code: A610304
Semester: 3rd

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to :

CO 1	Explain the concept of the entropy and randomness, distribution of four distinguishable particles in two compartment of equal size
CO 2	Differentiate Carnot cycle and their efficiency of conversion of heat into work and vice versa
CO 3	Demonstrate the Concept of macro states microstates, thermodynamic probability and Effects of constraints on the system
CO 4	Build a variety of mathematical skills to deal with statistics behavior of microscopic systems and become familiar with various thermodynamic process and work done in each of this process.
CO 5	Examine in depth about statistical distribution and have basic Ideas about Maxwell boltzman ,Bose-Einstein and Fermi Dirac Statistics and their applications

Course Contents

SECTION-A

Thermodynamics: Laws of Thermodynamics: The zeroth law; indicator diagrams, work done, the first law, internal energy, Carnot cycle, Carnot's theorem, the second law. Entropy as a thermodynamic variable; reversible and irreversible processes. Principle of increase of entropy.Thermodynamic scale of temperature; its identity with perfect gas scale, impossibility of attaining absolute zero.

SECTION-B

Basic ideas of Statistical Physics: Scope of statistical physics with examples, Concept of macro states. microstates, thermodynamic probability, Effects of constraints on the system, distribution of n particles in two compartments, Deviation from the state of maximum prabability, equilibrium state of dynamic system, Distribution of distinguishable n particles in k compartments of unequal sizes.

SECTION-C

Maxwell Boltzmann Statistics : Phase space and its division into elementary cells, Three kinds of statistics. The basic approach in the three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of Maxwell Boltzman law of distribution of molecular speeds,

SECTION-D

Bose-Einstein Statistics : Need for quantum statistics-Bose-Einstein (B.E.) statistics, Derivation of

Planck's law of radiation, Deduction of Wien's displacement law and Stefan's law from Planck's law, Fermi-Dirac (F.D.) statistics, Comparison of M.B., B.E. and F.D. statistics.

REFERENCE BOOKS

1. V.S. Bhatia, *Statistical Physics and Thermodynamics*, SohanLalNagin Chand, Jalandhar
2. A.K. Sikri, *Statistical Physics and Thermodynamics*, Pardeep Publication, Jalandhar
3. M.N. Saha& B.N. Srivastava (1965), *A Treatise on Heat*, The Indian Press pvt.Ltd., Allahabad
4. Bhattacharjee J. K(2000) ,*Statistical Mechanics : An Introductory Text*, Allied Pub., Delhi

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	-	2	3	1	2	3	2
CO2	2	3	1	3	2	1	3	1	3	2	1	2	1
CO3	3	1	3	2	2	3	2	3	1	-	2	3	3
CO4	2	3	-	2	-	2	1	-	2	2	3	2	2
CO5	3	1	2	3	3	1	3	2	3	1	2	1	3
Average	**2.2**	**2**	**2.2**	**2.2**	**2.5**	**2**	**2.2**	**2**	**2.4**	**1.5**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Optics
Course Code: A610305
Semester: 3rd

L T P
3 0 0

Credits: 03

: Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Explain the basic difference between interference and diffraction, and the concept of polarization and its applications
CO 2	Analyze the Michelson's interferometer experiment,nature of fringes, fringes width and its failure and outcomes.
CO 3	Solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations like fabry-perot and Newton rings
CO 4	Interpret various natural optical phenomenon which is happening in their surroundings.
CO 5	Work in aerospace, healthcare, robotics, manufacturing, automotive, and other industries with the firm foundation of optics and various optical instruments.

Course Contents

SECTION-A

Interference: Concept of coherence, Spatial and temporal coherence. Coherence time, Coherence length, Area of coherence,Conditions for observing interference fringes, Young's double slit experiment, Interference due to reflected and transmitted light,Interference by wave front division and amplitude division.

SECTION-B

Interferometers : Michelson's interferometers : working, Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings. Multiple beam intereference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

SECTION-C

Diffraction: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Frensel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging,Dispersive power of a grating, Rayleigh criterion, Maulus law, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.

SECTION-D

Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Wire grid polarisers, Retardation plates, Production and analysis of polarized light (quarter and half wave plates)

Reference Book:

1. Born and Wolf (1965.), *Optics* , Pergamom Press, 3rd edition
2. F.A. Jenkins and Harvery E. White (2001), *Fundamentals of Optics*, McGraw Hill 4th edition
3. Ajoy Ghatak(1997), *Optics*, McMillan India 2nd edition, 7th reprint
4. H.E. White, (1997) *Introduction to Atomic Spectra,* McGraw Hill Book Co.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	-	3	1	2	3	2
CO2	2	3	-	3	2	1	3	1	3	2	1	2	1
CO3	3	2	3	2	2	3	2	3	1	-	2	3	3
CO4	2	3	1	2	1	2	1	2	2	2	3	2	2
CO5	3	1	2	-	3	1	3	2	-	1	2	1	3
Average	**2.2**	**2.2**	**2.2**	**2**	**2.2**	**2**	**2**	**2**	**2.2**	**1.5**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Quantum Mechanics
Course Code: A610306
Semester: 3rd

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Comprehend Blackbody radiation, Ultraviolet catastrophe,Photoelectric effect and Compton Effect and being aware how quantum theory emerged
CO 2	Explain the need for quantum mechanical formalism and basic principles of wave mechanics and some problems of mechanics.
CO 3	Demonstrate about wave properties of particles,De Broglie waves and its implications on theuncertainty principle.
CO 4	Derive Schrodinger's equation for spherical symmetric potential, complete solution of hydrogen atom and able to solve numerical problems related to these topics.
CO 5	Design, set up and carry out experiments, analyze data recognizing and accounting for uncertainties and compare results with theoretical predictions.

Course Contents

SECTION-A

Foundation of Quantum Mechanics: Brief introduction to need and development of quantum mechanics, Spectral radiation – Planck's law. Photoelectric effect – Einstien's photoelectric equation.Compton's effect (quantitative) experimental verification.Stability of an atom – Bohr's atomic theory.Limitations of old quantum theory.

SECTION B

Matter Waves:de Broglie's hypothesis – wavelength of matter waves, properties of matter waves. Phase and group velocities. Davisson and Germer experiment. Double slit experiment. Standing de Brogile waves of electron in Bohr orbits.

SECTION C

Uncertainty Principle: Heisenberg's uncertainty principle for position and momentum (x and px), Energy and time (E and t). Gamma ray microscope. Diffraction by a single slit. Position of electron in a Bohr orbit.Particle in a box.Complementary principle of Bohr.

SECTION D

Schrodinger Wave Equation: Schrodinger equation -time dependent and steady state forms, expectation value, Particle in a box, , Potential step, Potential barrier, Rectangular potential well, Schrodinger equation for hydrogen atom, separation of variables, quantum numbers.

Reference Books:

1. V.K. Thankappan(2000), *Quantum Mechanics*, McGraw Hill Pub. Co. Delhi
2. P.M. Mathews and K. Venkatesan (2002), *A Text Book of Quantum Mechanics*, Tata McGraw Hill Pub. Co. Delhi,.
3. J .L. Powell and B. Crasemann(1997), *Quantum Mechanics*, Narosa Pub. House, N.Delhi

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	2	3	1	2	3	2

CO 2	2	3	1	-	2	1	3	1	-	2	1	2	1
CO 3	1	2	3	2	2	3	2	3	1	3	2	3	3
CO 4	2	3	1	2	1	2	1	2	2	2	3	2	2
CO 5	3	1	2	3	-	1	3	-	3	1	2	1	3
Average	**2**	**2.2**	**2**	**2**	**2**	**2**	**2**	**2**	**2.2**	**1.8**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Inorganic Chemistry - III

Course Code: 610307

Semester: 3

Credits: 02

L	**T**	**P**
2	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	**Statement**
CO1	Explain and determine the electronic structure of transition metal complexes and the Properties of these complexes.
CO2	Use the applications of selected transition elements and their compounds.
CO3	Describe the application of radioactive elements as well as their creation and decay.
CO4	Explain what kind of parameters that affect the crystal structure of a compound and perform calculations of the lattice enthalpy of ionic multifarious
CO5	Analyze chemistry of separation of Np, Pu and Am from U.

COURSE CONTENT

SECTION-A

Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements, Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry chemistry of Lanthanide Elements. Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds

SECTION-B

Ill. Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radiioxidation states, Magnetic behaviour, spectral properties & stereochemistry

IV. Chemistry of Actinides Elements

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Reference Books:

1. Porterfield, W. W. (2013). *Inorganic chemistry*. Academic press.
2. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). *Inorganic chemistry: principles of structure and reactivity*. Pearson Education India.
3. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., & Grimes, R. (1988). *Advanced inorganic chemistry* ,New York: Wiley.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	-	3	1	2	3	2
CO2	2	3	1	-	2	1	3	1	3	2	1	2	1
CO3	1	2	3	2	2	3	2	3	1	1	2	3	3

CO4	2	1	1	2	1	2	3	2	2	-	3	2	2
CO5	3	1	2	3	-	1	3	2	-	3	2	1	3
Average	2	2.2	2	2	2	2	2.2	2	2.2	1.7	2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: ORGANIC CHEMISTRY – III

Course Code: 610308

Semester: 3

Credits:

L	**T**	**P**
2	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	**Statement**
CO1	Develop understanding to solubility and complex ion equilibria
CO2	Predict the major and minor products of a variety of organic reactions with appropriate stereochemistry and radiochemistry.
CO3	Draw the structure of an organic molecule using substitutive and/or functional class IUPAC nomenclature
CO4	Devise reasonable high-yield synthesis of a target molecule from given organic starting materials
CO5	Analyze the importance of alkaloids and terpinoids.

COURSE CONTENT

Section - A

Alcohols:

Classification and nomenclature, Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters, Hydrogen bonding, Acidic nature, Reactions of alcohols, Dihydric alcohols-nomenclature, methods of formation, chemical reactions of

vicinal glycols, Pinacol-Pinacolone rearrangement. Trihydric alcohol-nomenclature, methods off formation and chemical reactions of glycerol.

-Phenols: Nomenclature, structure and bonding, Preparation of Phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxideion, Reaction of phcnols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Reimer-Tiemann reaction

Section - B

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

aldehyes and ketones. Physical properties and Mechanism of nucleophilic addition to carbonyl group with particular emphasis ofBenzoin, Aldol, Perkin and Knoevenagel condensations, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, LiAIH4 and NaBH4 reductions. Halogenation of enolizable ketones. An Introduction to □, □ unsaturated aldehydes and ketones, Michael addition.

Reference Books:

1. Morrison, R. T., & Boyd, R. N. (1987). Organic chemistry.
2. Finar, I. L. (1959). *Organic Chemistry*: The Fundamental Principles v.
3. Abernethy, J. L. (1957). Organic chemistry, Vol. II: Stereochemistry and the chemistry of natural products (Finar, IL).
4. Solomons, T. G., Fryhle, C. B., & Snyder, S. A. (2016). *Organic Chemistry, 12e Binder Ready Version Study Guide & Student Solutions Manual*. John Wiley & Sons.Sons.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	-	3	1	2	3	1	2	3	2
CO2	2	3	1	-	2	1	3	1	-	2	3	2	1
CO3	1	2	3	2	1	3	2	3	1	1	2	3	3
CO4	2	1	1	2	1	2	3	2	2	2	3	2	2
CO5	3	1	2	3	3	1	3	-	3	-	2	1	3
Average	2	2.2	2	2	1.7	2	2.2	2	2.2	1.5	2.2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHYSICAL CHEMISTRY - III

Course Code: 610309

Semester: 3

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Develop a competent knowledge of classical thermodynamic principles.
CO2	Compare the thermodynamic principles and statistical mechanics
CO3	Apply principles to a variety of phase (gas, liquid, solid) and reaction equilibria.
CO4	Design practical engines using thermodynamic cycles.
CO5	Analyze the Variation of G and A with P, V andT.

COURSE CONTENT

Section – A

Thermodynamics-I

Definition of thermodynamics terms: system, surroundings etc. Types of systems, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermos chemistry

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 and inversion temperature, Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversibleprocess.

Thermodynamics-II-

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem, Thermodynamic scale of temperature

SECTION-B

Thermodynamics-II-(Part-b)

Concept of 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, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A &Gas criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Reference Books:

1. Kozliak, E. I. (2004). Introduction of entropy via the Boltzmann distribution in undergraduate physical chemistry: A molecular approach. *Journal of chemical education*.
2. Sabaté, R., Freire, L., & Estelrich, J. (2001). Influence of dielectric constant on the spectral behavior of pinacyanol. A spectrophotometric experiment for physical chemistry. *Journal of Chemical Education*.
3. Mortimer, R. G. (1999). *Mathematics for physical chemistry*. Academic Press.
4. Barrow, G. M. (1980). Computer-based studies for physical chemistry. *Journal of Chemical Education*.
5. Johnson, L. E., & Engel, T. (2011). Integrating computational chemistry into the physical chemistry curriculum. *Journal of Chemical Education.*

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	3	1	2	3	1	-	3	2
CO2	3	3	1	-	-	1	3	1	3	2	1	2	1
CO3	1	1	3	2	2	3	2	-	1	3	2	3	3
CO4	2	3	1	2	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	1	-	1	2	1	3
Average	2	2	2	2	1.7	2	2	1.5	2.2	1.8	2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Physics III- Lab
Course Code: 610310

Semester: 3rd

L T P

Credits:01 **0 0 4**

Course Outcomes: On successful completion of this course, the students will able to:

CO	Statement
CO1	Develop skills in assessing the quality of one's own and others' work.
CO2	Apply the principles and skills learned in the classroom to on-the-job practices and procedures
CO3	Recognize the relationship between the conceptual description of nature and its mathematical expression.
CO4	Estimate sources of error in a measurement.
CO5	Make measurements on physical systems.

COURSE CONTENT LIST OF EXPERIMENTS

1. Adiabatic expansion of agas
2. Thermal expansion of crystal using interferencefringes
3. Probability distribution using coloured dicecoins.
4. To determine the refractive index of liquid usingspectrometer
5. To determine the Cauchy'sconstants
6. To study the refractive index of doubly refractingprism
7. To determine the wave length of a given light usingbi-prism
8. To determine the resolving power of atelescope
9. To determine the principal points of a lenssystem
10. Study the photoelectric effect and determine the value of Planck'sconstant
11. To study the gas discharge spectrum ofhydrogen
12. To determine the angle of wedge using interferencemethod
13. To check if triangle exists and the type of the triangle

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	1	3	3	1	3	-	1	2	3	2
CO2	3	3	1	1	-	1	3	1	3	2	1	2	1
CO3	1	1	3	2	2	3	2	3	1	3	2	3	3
CO4	3	3	1	-	1	2	1	2	2	-	3	2	2
CO5	3	1	3	3	1	1	3	-	3	1	2	1	3
Average	**2.2**	**2**	**2.2**	**1.7**	**1.7**	**2**	**2**	**2.2**	**2.2**	**1.7**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

CHEMISTRY – III Lab

Course Code: 610311

Semester: 3rd

L T P

Credits: 01 **0 0 4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Describe the fundamentals of acid/base equilibria, including pH calculations, buffer behavior, acid/base titrations, and their relationship to electrophones and nucleophiles
CO2	Use General periodicity patterns of (organic/inorganic) molecules, and the ability to design Synthetic approaches to such species.
CO3	General chemical equilibrium
CO4	Estimation of ferrous and ferric by dichromate method.
CO5	Estimate the calcium content in chalk as calcium oxalate by permanganometry

COURSE CONTENT

Volumetric Analysis and TLC
Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH, Arkalimity of watersample.
(b) Determination of alkali content ofantacid.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(d) Estimation of hardness of water by EDTA.
(e) Estimation of ferrous and ferric by dichromatemethod.
(f) Estimation of copper using sodiumthiosulphate.

Organic Chemistry

Laboratory

Techniques

Thin Layer Chromatography
Determination of R, values and identification of organic compounds
(a) Separation of green leaf pigments (spinach leaves may beused)
(b) Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzo phenome cyclohexanone using toluene and light petroleum (40:60).
(c) Separation of a mixture ofdyes

Reference Books:

1. AI, V. Furniss BS. Hannaford AJ. Smith PWG. Tatchell AR. *Vogel's Textbook of Practical*

Organic Chemistry, 920.

2. Ahluwalia, V. K., & Aggarwal, R. (2001). *Comprehensive practical organic chemistry: preparation and quantitative analysis*. Universities Press.
3. Ahluwalia, V. K., & Dhingra, S. (2004). *Comprehensive Practical Organic Chemistry: Qualitative Analysis*. Universities Press.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	3	1	-	1	1	2	3	2
CO2	3	3	1	1	-	1	3	1	3	2	1	2	3
CO3	1	1	-	2	2	3	2	3	1	3	2	3	3
CO4	3	3	1	2	1	2	1	2	2	-	3	2	2
CO5	3	1	2	3	1	1	3	2	-	1	2	1	3
Average	**2.2**	**2**	**1.7**	**2**	**1.7**	**2**	**2**	**2**	**1.7**	**1.7**	**2**	**2.2**	**2.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: English-I
Course Code: 610312
Semester: 3rd

Credits 03 **L T P**
3 0 0

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Improve their speaking ability in English both in terms of fluency and comprehensibility

CO2	Give oral presentations and receive feedback on their performance
CO3	Increase their reading speed and comprehension of academic articles
CO4	Heighten their awareness of correct usage of English grammar in writing and speaking

Course Outcome

General reading, Vocabulary building and translation, An anthology of modern prose and poetry for intensive study; a book of biographies for general reading.

Sequence of tenses; antonyms; synonyms; one-word substitution; formation of words; words used as different parts of speech; transformation of sentences: simple, compound and complex; interchange of voice, narration and degrees of comparison; letter writing for personal communication. Translation from English into vernacular. A special question for foreign students in lieu of translation.

Reference Books:-

1. Andrew Strauss, (1996), "*An anthology of modern prose"*, Macmillan London.
2. Wren & Martin,(2005) "*English Grammar and Composition*" BLACKIE.
3. SC Gupta,(2012) "*English Grammar and Composition*", Arihant.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	1	3	3	1	3	-	1	2	3	2
CO2	3	3	1	1	-	1	3	1	3	2	1	2	1
CO3	1	1	3	2	2	3	2	3	1	3	2	3	3
CO4	3	3	1	-	1	2	1	2	2	-	3	2	2
CO5	3	1	3	3	1	1	3	-	3	1	2	1	3
Average	**2.2**	**2**	**2.2**	**1.7**	**1.7**	**2**	**2**	**2.2**	**2.2**	**1.7**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Linear Algebra
Course Code: 610401
Semester 4th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Recall and define Groups, Fields and their properties and Cite examples of vector spaces, subspaces and linear transformations
CO2	Solve the systems of linear equations, Analyze vectors in R^ n geometrically and algebraically and distinguish Bi dual space and natural isomorphism
CO3	Determine the concepts of linear independence, linear dependence , basis and dimension of vector spaces with Existence theorem
CO4	Correlate rank and nullity, Linear transformation and matrix of a Linear transformation and examine whether a given space is an inner product space or orthonormal set.

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Vector spaces over a field, subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence and independence, Basis, Finite dimensional spaces, Existence theorem for bases in the finite dimensional case, Invariance of the number of vectors in a basis, dimension, Existence of complementary subspace of any subspace of a finite-dimensional vector space,

Unit-2

Dimensions of sums of subspaces, Quotient space and its dimension, Matrices and linear transformations, change of basis and similarity. Algebra of linear transformations, The rank-nullity theorem, Change of basis, Dual space. Bidual space and natural isomorphism, Adjoints of linear transformations, Eigenvalues and eigenvectors.

Unit-3

Determinants, characteristic and minimal polynomials, Cayley-Hamilton Theorem.Annihilators, Diagonalization and Triangularization of operators, Invariant subspaces and decomposition of operators, Canonical forms. Inner product spaces, Cauchy-Schwartz inequality, Orthogonal vectors and orthogonal complements.

Unit-4

Orthonormal sets and bases, Bessel's inequality, GramSchmidtorthogonalization method, Hermitian, Self-Adjoint, Unitary, and Orthogonal transformation for complex and real spaces, Bilinear and Quadratic forms, The Spectral Theorem, The structure of orthogonal transformations in real Euclidean spaces.

Reference Books:-

1. Kumaresan, S., (2000)*: Linear Algebra, a Geometric Approach*. 75. Kuroah, A., Higher Algebra. 76. Lewis, Matrix Theory
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul (2012). *First Course in Linear Algebra.* Wiley Eastern Delhi.
3. J. Gilbert and L. Gilbert. (1990). *Linear Algebra and Matrix Theory*. Academic Press.
4. S.Singh and Q Zameeruddin, *Modern Algebra* (Delhi, Vikas).
5. I.N. Herstein. (2006). *Topics in Algebra*. Wiley.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	1	2	2	1	2	2	1	2
CO2	3	3	2	3	2	2	2	-	2	3	1	2	2
CO3	2	2	3	2	1	-	2	2	-	3	1	1	3
CO4	2	2	2	2	1	2	-	2	2	2	2	2	2
Average	**2.25**	**2.25**	**2.5**	**2.25**	**1.25**	**1.6**	**2**	**2**	**1.6**	**2.5**	**1.5**	**1.5**	**2.25**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Analysis II
Course Code: 610402
Semester 4th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Solve simultaneous linear equations with constant coefficients and total Differential equations.
CO2	Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y.
CO3	Extract the solution of differential equations of the first order and of the first Degree by variables separable, Homogeneous and Non-Homogeneous methods.
CO4	Describe the solution of First order partial differential equations for some standard Types. Form partial differential equations.

Course content

Credits 03 **L T P**
3 0 0

Unit-1

Partial differential equations,Formation of partial differential equations, Types of solutions, PDEs of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general methods.

Unit-2

Partial differential equations of second and higher order, Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.

Unit-3

Derivatives, Rolle'stheorem, Mean Value Theorem, Darboux's theorem on intermediate value property of derivatives, Taylor's theorem. Indeterminate forms.
Integration,The Riemann Integral and its properties.Integrability of continuous and monotonic functions.Functions of bounded variation, their relation with monotonic functions and integrability.

Unit-4

Convergence of improper integrals.Beta and Gamma functions.Frullani's integral. Integral as a function of a parameter and its continuity, differentiability and integrability.

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REFERENCES BOOKS

1. Gupta, A. S., (2005). *Calculus of Variations,* Prentice Hall of India, New Delhi.
2. Miller, F. H. (2017). *Partial Differential Equations*, John Wiley and Sons.
3. E. Coddington & N. Levinson (1972). *Theory of Ordinary Differential Equations*, Tata Mc-Graw Hill, India.
4. S.L. Ross. (1984). *Differential Equations*, 3rd edition, John Wiley & sons (Asia).
5. D.A. Sanchez. (1968). *Ordinary Differential Equations & Stability Theory*. Freeman & company.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	1	2	3	2	2	2
CO2	3	2	2	3	2	-	2	2	-	3	1	2	2
CO3	2	2	3	2	1	2	-	2	2	2	2	2	3
CO4	2	2	3	2	2	1	2	-	2	3	2	1	2
Average	**2.25**	**2.25**	**2.5**	**2.25**	**1.5**	**1.2**	**2**	**1.6**	**2**	**2.75**	**1.75**	**1.75**	**2.25**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Mechanics –II
Course Code: 610403
Semester 4th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Define Motion of a particle with constant acceleration , acceleration of falling bodies, motion under gravity, motion of a body projected vertically upward,
CO2	Explain Projectile, impulse, impact and laws of impact and Prove that the path of a projectile is a parabola Explain Projectile, impulse, impact and laws of impact
CO3	Derive the Relative motion, relative displacement, velocity and acceleration, motion relative to a rotating frame of reference , Linear momentum, angular momentum, conservation of angular momentum, impulsive forces,
CO4	Determine the Composition of Simple Harmonic Motion and the differential equation Of a central orbit.

Course content

Credits 03 **L T P**
3 0 0

Unit-1

Dynamics: Motion of a particle with constant acceleration , acceleration of falling bodies, motion under gravity, motion of a body projected vertically upward, motion of a two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane.

Unit-2

Variable acceleration: Simple harmonic motion, elastic string. curvilinear in a plane, Definition of velocity and acceleration , Projectile, motion in a circle, motion under constraints, central force motion. Work, Power, conservative fields and potential energy, work done against gravity, potential energy of a gravitational field.

Unit-3

Relative motion, relative displacement, velocity and acceleration, motion relative to a rotating frame of reference. Linear momentum, angular momentum, conservation of angular momentum, impulsive forces, principle of impulse and momentum.

Unit-4

Motion with respect to centre of mass of a system of particles, collisions of elastic bodies, loss of energy during impact.Free vibration, the simple pendulum, the conical pendulum.Central Orbit.Kepler's laws of motion.

Reference Books:

1. S.L. Loney: (1947). *The elements of statics and dynamics*, 5th edition, Cambridge University
2. Blanchard, F., Maass, A., & Nogueira, A. (Eds.). (2000). *Topics in symbolic dynamics and applications* (Vol. 279). Cambridge university press.
3. Weatherburn, C.E. (1924). *Advanced Vector Analysis*. G. Bell and Sons, Ltd...
4. Goldstein H., Poole, C. and Safko, J. (2002). *Classical Mechanics*. 3rd Edition, Addison Wesley.
5. Spiegel, M. Lipchitz, S and Spellman, D. (2009). *Vector Analysis*. Schaum Outline Series. McGraw Hill.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	1	2	2	1	2	2	2	2
CO2	3	3	2	3	2	2	2	2	2	3	2	2	3
CO3	2	2	2	3	1	2	-	2	-	3	2	3	3
CO4	3	2	2	3	2	-	1	-	2	3	3	3	3
Average	**2.5**	**2.25**	**2.25**	**2.75**	**1.5**	**1.6**	**1.6**	**2**	**1.6**	**2.75**	**2.25**	**2.5**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Statistical Physics and Thermodynamics-II
Course Code: A610404
Semester: 4th

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Give details of the concept of the Statistical definition of entropy, Change of entropy of a system and Additive nature of entropy
CO 2	analyze Carnot cycle and their efficiency of Carnot engine, Entropy changes in Carnot cycle and Applications of thermodynamics to thermoelectric effect.
CO 3	Interpret the effect of change in pressure and temperature on the equilibrium transition.
CO 4	Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
CO 5	Differentiate interrelationship between thermodynamic functions and skills to use such relationships to solve practical problems.

Course Contents

SECTION A

Thermodynamics: Statistical definition of entropy, Change of entropy of a system, Additive nature of entropy, Law of increase of entropy, Reversible and irreversible process and their examples. Work done in a reversible process. Examples of increase of entorpy in natural processes, Entropy and disorder, Brief review of terms and laws of thermodynamics,

SECTION B

Carnot engine and entropy : Carnot's cycle, Entropy changes in Carnot cycle. Applications of thermodynamics to thermoelectric effect. Change of entropy along a reversible path in a P.V. diagram, Entropy of a perfect gas, Equation of state of an ideal gas from simple statistical consideration, Heat death of the universe.

SECTION C

Maxwell's thermo dynamical relations :Derivation of Maxwell's thermo dynamical relations, Cooling produced by adiabatic streching, Adiabatic compression, Change of internal energy with volume, specific heat at constant pressure and constant volume, Expression for Cp -Cv ,

SECTION D

Kinetic Theory of Gases : Change of state and Clayperon equation, Thermo dynamical treatment of Joule-Thomson effect, Use of Joule-Thomson effect, liquefiction of helium, Production of very low temperature by adiabatic demagnetization.

REFERENCE BOOKS

1. V.S. Bhatia,*(2000) Statistical Physics and Thermodynamics*, SohanLalNagin Chand, Jalandhar
2. A.K. Sikri,(2002), *Statistical Physics and Thermodynamics*, Pardeep Publication, Jalandhar
3. M.N. Saha& B.N. Srivastava (1965), *A Treatise on Heat*, The Indian Press pvt.Ltd., Allahabad
4. Bhattacharjee J. K(2000) ,*Statistical Mechanics : An Introductory Text*, Allied Pub., Delhi
5. Bhattacharjee, J.K(2000), *Statistical Physics*, Allied Pub., Delhi
6. B.B. Laud (1981), *Statistical Mechanics*, Macmillan India Ltd,

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	1	3	3	1	-	1	1	2	3	2
CO2	3	3	1	1	3	1	3	1	3	2	1	2	3
CO3	1	1	3	2	2	3	2	3	1	-	2	3	3
CO4	3	3	1	-	1	2	1	2	2	2	3	2	2

CO5	1	1	2	3	-	1	1	2	-	1	2	1	1
Average	**2**	**2**	**1.7**	**1.7**	**2.2**	**2**	**2.2**	**2**	**1.7**	**1.5**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: LASER Physics
Course Code: A610405
Semester: 4th

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Derive the Concept of stimulated emission and population inversion and Broadening of spectral lines
CO 2	Explain about basic concepts of the LASER and its fundamentals,Longitudinal and transverse modes.
CO 3	Explain the principles and design considerations of various (solid state, gas and semiconductor) lasers, modes of their operation and areas of their application
CO 4	Test the origin and different line spectra and different levels of laser and three and four level laser schemes.
CO 5	Analyze the working of optical fiber and their applications in communication, Ruby and Nd: YAG lasers, He-Ne and CO_2lasers and Gain the basic skills of practical work with lasers.

Course Contents

SECTION A

Laser Fundamentals : Derivation of Einstein's coofficient. Concept of stimulated emission Absorption, spontaneous emission and population inversion coherence . Broadening of spectral lines, natural , collision and Doppler broadening. Line width, line profile, Absorption and amplification of a parallel beam of light passing through a medium.

SECTION –B

Derivation of Threshold condition : Introduction of three levels and four levels laser schemes,elementary theory of optical cavity, Longitudinal and transverse modes. Q- switching ,Mode locking, Applications of lasers-a general outline. Basic of holography.

SECTION –C

Laser Systems: Types **of** lasers, Ruby and Nd: YAG lasers, He-Ne and CO_2 leasers-construction, mode of creating population inversion and output characterstics. Semiconductor lasers, Dye lasers.

SECTION – D

Optical Fibre : Fibre types, Fibre Materials, Fibre structure , optical paths Acceptance angle and numerical aperture Measurement of fiber characteristics optical fibre communication system

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REFERENCE BOOK

1.W.T. Silfvast(1996), *Laser Fundamentals*, Foundation Books, New Delhi,

2. B.B. Laud (2002), *Lasers and Non-linear Optics*, New Age Pub.

3. Svelto,(2003) *Lasers*, Plenum Press, 3rd Ed., New York.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	2	3	3	1	-	1	-	2	3	2
CO2	3	3	1	1	3	1	3	1	3	2	1	2	3
CO3	1	1	3	2	2	3	2	3	1	1	2	3	3
CO4	3	3	1	1	-	2	1	2	2	2	3	2	2
CO5	1	1	2	3	1	1	1	2	-	1	2	1	1
Average	**2**	**2**	**1.7**	**1.8**	**2.2**	**2**	**2.2**	**2**	**1.7**	**1.5**	**2**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Atomic Spectroscopy

Course Code: 610413
Semester:4th

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Explain the concept of Excitation of atom with radiation, Transition probability and Spin orbit coupling (electron magnetic moment, total angular momentum)
CO 2	Comprehend the spectrum of hydrogen with full details and to analyze the spectrum of hydrogen with all parameters.

CO 3	Discuss about Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling
CO 4	Differentiate Selection rules, Regularities in atomic spectra, Interaction energy, X-ray spectra, Mosley law, and Absorption spectra.
CO 5	Analyze the mechanics and Parameters of different experimentsand spectra's like frank-hertz experiment, Raman Spectra and X-ray Spectra.

Course Contents

SECTION-A

One Electron Atomic Spectra: Excitation of atom with radiation. Transition probability, Spontaneous transition.Selection rules and life time.Spectrum of hydrogen atom. Frank Hertz Experiment, Line structure.

SECTION B Zeeman and PaschenEffect : Normal Zeeman effect, Electron spin, Stern Gerlach experiment, Spin orbit coupling (electron magnetic moment, total angular momentum),Hyperfine structure, Examples of one electron systems, Anomalous, Zeeman effect, Lande-g factor (sodium D-lines).

SECTION-C

Many Electron System Spectra: Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling, Selection rules, Regularities in atomic spectra, Interaction energy.

SECTION-D **X-ray spectra:** Production of X-rays, X-ray diffraction, Bragg's law, Bragg's spectrometer, Reflection and refraction of X-rays, Continuous X-ray spectrum, characteristics absorption and emission Spectra, Moseley's law, Applications of Moseley's law

REFERENCE BOOKS

1. Arthur Beiser(1995), *Concepts of Modern Physics*, McGraw Hill Pub.Co., Delhi, 9th ed.
2. S.H. Patil(1998), *Elements of Modern Physics*, McGraw Hill.
3. E. Merzbacher(2000), *Quantum Mechanics*, John Wiley, 2nd ed.
4. C.N. Banwell(2001), *Fundamental of Molecular Spectroscopy*, Tata McGraw Hill Pub. Co., Delhi.
5. H.G. Kuhn (1969), *Atomic Spectra*, Longmans, 2nd ed., 1969.
6. L. Pauling and E.B. Wilson(2002) , *Introduction to Quantum Mechanics*, Tata McGraw Hill Pub. Co., Delhi.
7. W. Greiner(1994), *Quantum Mechanics*, Springer Verlag.

The mapping of PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	2	1	3	1	-	1	3	2	1	2
CO2	1	1	1	1	3	1	3	1	3	2	1	2	3
CO3	1	1	3	2	2	3	2	3	-	1	-	3	3
CO4	3	2	1	-	1	2	1	2	2	2	3	2	2
CO5	1	1	3	3	1	1	3	2	3	1	2	1	1
Average	**2**	**2**	**2**	**2**	**1.8**	**2**	**2.4**	**2**	**2.2**	**2.2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Inorganic Chemistry - IV

Course Code: 610407

Semester: 4th

Credits:

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	Describe the properties of coordination complexes and thereby synthesizing new Co-ordination complexes.
CO2	Apply current chemistry models/theories to understand and predict the physical/electronic properties, bonding, and reactivity that occur in inorganic complexes with emphasis on coordination complexes containing transition metals.
CO3	Construct qualitative sets of molecular orbital for simple molecules and inorganic complexes
CO4	Relate structure of molecule with strength of acidity and basicity.
CO5	Analyze Physical properties of a solvent, types of solvents and their general characteristics.

COURSE CONTENT

Section - A

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 complex

Oxidation and Reduction

Principles involved in the extraction of the elements.

Section – B

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Reference Books:

1. *Inorganic Chemistry*. D.E. Shriver, P. W. Aikins and C.H. Langford.<Oxford.
2. W. W. Porterfield , (2005), *Inorganic Chemistry*. Addison. Wesley
3. . G.L. Miessler and O.A. Tarr *(2004), Inorganic Chemistry*, PrenticeHall.
4. Shriver, D.D. & P. Atkins, *Inorganic Chemistry 2nd Ed.*, Oxford University Press, 1994.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	1	1	-	1	1	2	3	2
CO2	1	3	1	1	-	1	3	1	3	-	1	2	3
CO3	1	1	-	2	2	3	2	3	1	1	2	3	3
CO4	3	2	1	1	1	2	1	2	-	2	3	2	2
CO5	3	1	3	-	1	1	1	2	3	3	2	1	1
Average	2	2.2	1.7	1.5	1.7	1.6	2.2	2	2	2	2	2.2	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: ORGANIC CHEMISTRY - IV

Course Code: 610408

Semester: 4th

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to::

CO	Statement
CO1	Explain the role of Carboxylic groups in syntheses of oils and fats.
CO2	Calculate the saponification value of various oils.
CO3	Describe the cleansing action of soaps and detergents.
CO4	Use knowledge of the process of hydrogenation.
CO5	Estimate the structure and nomenclature of amines.

COURSE CONTENT

Section – A

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation

Methods of formation and chemical reaction of unsaturated monocarboxylic acids, dicarboxylic acids, methods of formation 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 acylderivatives

Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterification and hydrolysis (acidic and Basic)

SECTION-B

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autoxidation, Zeisel's Method

Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and arylsulphonates Organic Compounds ofNitrogen

Nitro Compounds

Preparation of nitro alkanes and nitroarenes, Chemical reactions of nitro alkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media,

Picric acid

Amines Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines Separation of a mixture secondary and tertiary amines. Structural features effecting the basicity ofamines.

Reference Books:

1. Morrison and Boyd ,*(2005), Organic Chemistry.*, Prentice Hall.
2. L.G. Wade , (2009), *Organic Chemistry.* lr.Prentice Hall.
3. Solomons , *(2010), Fundamentals of Organic Chemistry.*, JohnWiley.
4. . S.M. Mukherji, S.P. Singh and R.P. Kapoor ,*(2012), Organic Chemistry.* Vol. I, II & III, Wiley Eastern Ltd. (New AgeInternational)

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	-	2	1	1	1	-	1	1	2	1	2
CO2	3	3	1	1	3	1	3	1	3	-	1	2	3
CO3	1	1	3	2	2	3	2	3	1	1	2	3	3
CO4	3	2	1	1	1	2	1	2	2	2	-	2	2
CO5	3	1	3	-	1	1	1	2	-	2	2	1	1
Average	2.4	2.2	2	1.5	1.8	1.6	2.2	2	1.7	1.5	1.7	1.8	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHYSICAL CHEMISTRY - IV

Course Code: 610409

Semester: 4th

Credits:02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	Understand the basics of electrochemistry and relationship of electrical parameters to Thermodynamic and Stoichiometric parameters.
CO2	Understanding the fundamentals of acid/base equilibrium including pH calculations, Buffer behavior, acid / base titrations
CO3	Demonstrate the phases of matter, phase changes and construction of phase diagrams.
CO4	Describe the methodology of modern science, the relationship between observations and theory, and the foundational principles that underlie the scientific process.
CO5	Determine the use of pH using hydrogen, quinhydrone and glass electrodes

COURSE CONTENT

Section – A

Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action, Le Chatelier's principle

Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag sytem,

Desilverisation of lead. Liquid-Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system-azeotropes-HCI-HP and ethanol-water systems, Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation, Nernst distribution law, thermodynamic derivation & applications

Electrochemistry-l

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations, Debye- Huckel-Onsagar's equation for strong electrolytes (elemental treatment only)

SECTION-B

Electrochemistry-II

Types of reversible electrodes--gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes, Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode, potential, sign conventions, electrochemical series and its significance. Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells, EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage, Concentration cell with and without transport, liquid junction potential, application of concentration cells, valence of ions, solubility product and activity coefficient potentiometric titrations. Definition of pH and pK., determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods, Buffers--mechanism

of buffer action, Henderson-Hazel equation, Hydrolysis of salts, Corrosion-types, theories and methods of combating it.

Reference Books:

1. Kozliak, E. I. (2004). Introduction of entropy via the Boltzmann distribution in undergraduate physical chemistry: A molecular approach. *Journal of chemical education*.
2. Sabaté, R., Freire, L., & Estelrich, J. (2001). Influence of dielectric constant on the spectral behavior of pinacyanol. A spectrophotometric experiment for physical chemistry. *Journal of Chemical Education*.
3. Mortimer, R. G. (1999). *Mathematics for physical chemistry*. Academic Press.
4. Barrow, G. M. (1980). Computer-based studies for physical chemistry. *Journal of Chemical Education*.
5. Johnson, L. E., & Engel, T. (2011). Integrating computational chemistry into the physical chemistry curriculum. *Journal of Chemical Education*.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	3	1	-	1	1	2	1	2
CO2	3	1	-	1	3	1	3	1	3	2	1	2	3
CO3	1	1	3	2	2	3	2	3	1	1	2	3	3
CO4	3	2	1	1	1	2	1	2	2	2	3	2	2
CO5	1	1	3	-	1	1	1	2	-	1	2	1	1
Average	2.2	2	2.2	1.5	1.8	2	2.2	2	1.7	2	2	1.8	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Physics- IV Lab
Course Code: 610410

Semester: 4th

L T P

Credits:01 **0 0 1**

Course Outcomes: On successful completion of this course, the students will able to:

CO	Statement
CO1	Demonstrate Structural and functional aspects of basic unit of life i.e. cell concepts
CO2	Apply Knowledge of eras and evolution of species
CO3	Describe Phylum Nematoda and give examples of pathogenic Nematodes
CO4	Classify Protista up to phylum using examples from parasitic adaptation
CO5	Make Interactions and interdependence of physiological and biochemical processes

COURSE CONTENT

LIST OF EXPERIMENTS

1. Thermal conduction in poor conductor (variation with geometry) by Lee's method
2. Thermo e.m.f. calibration comparison
3. Total radiation law, temperature dependence of radiation
4. Study of rotation of plane of polarization with a polarimeter.
5. Set up Newton's rings to determine wave length of sodium light
6. To determine the wave length and dispersive power using plane diffraction grating(Use Hg source)
7. To determine the resolving power of a grating
8. To measure an inaccessible height using sextant
9. To determine the divergence and wave length of a given laser source.
10. To study the absorption spectra of iodine vapours
11. To determine the ionization potential of mercury
12. Study of variation of light intensity using photovoltaic cell/inverse square law
13. To determine the angle of wedge using interference method
14. Calculation of days between two dates of a year.

The mapping of PO/PSO/CO attainment is as follows:-

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	2	2	-	2	1	1	1	3	2	1	2
CO2	2	1	1	1	3	1	3	1	3	2	-	2	3
CO3	3	1	-	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	3	3	-	1	1	3	-	-	1	2	1	1
Average	**2.2**	**1.6**	**1.7**	**1.5**	**1.7**	**1.8**	**2**	**1.7**	**1.7**	**2.2**	**2.2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: CHEMISTRY – IV Lab

Course Code: 610411

Semester: 4

Credits:

L	T	P
0	0	4

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Determine the thermodynamic and kinetic forces involved in chemical reactions which determine how much and how soon products are formed
CO2	Use the Methods to measure equilibrium concentrations and equilibrium constants for acid-base, solubility, and complexation reactions given initial concentrations of reactant
CO3	Check the Molecular-level by critical thinking skills
CO4	Derive the key concepts of inorganic and organometallic chemistry including those related tosynthesis, reaction chemistry, and structure and bonding
CO5	Apply the enthalpy of solution of solid calcium

COURSE CONTENT

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔHof the dissolutionprocess.
2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weakbase.
3. To determine the enthalpy of solution of solid calcium

chloride.

REFERENCE BOOKS

1. C.N.R. Rao and U.C. Aggarwal , (2010), *Experiments in General Chemistry*, , East-West Press.
2. R.C. Das, and B. Behra ,(2018), *Experiments in Physical Chemistry*, , Tata Mc-grawHill.
3. J.B. Yadav ,(2015), *Advanced Practical Physical Chemistry*, Goel PublishingHouse.
4. J.N. Gurutu and R. Kapoor ,(2013), *Advanced Exp. Chemistry*, Vol. I-Physical, S. Chand& Co

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	3	3	1	1	3	2	1	2
CO2	3	1	1	1	3	1	3	-	3	2	1	2	3
CO3	1	1	3	2	2	3	2	3	1	1	2	3	3
CO4	3	2	1	2	1	2	1	2	-	-	3	2	2
CO5	1	1	3	3	-	1	3	2	3	1	2	1	1
Average	**2.2**	**2**	**2**	**2**	**1.7**	**2**	**2.4**	**2**	**2**	**1.7**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: English - II

Course Code: 610412

Semester: 4th

Credits 03 **L T P**
3 0 0

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Improve their speaking ability in English both in terms of fluency and comprehensibility
CO2	Give oral presentations and receive feedback on their performance
CO3	Increase their reading speed and comprehension of academic articles
CO4	Heighten their awareness of correct usage of English grammar in writing and speaking

Section A

English reading, Comprehension, Paragraph writing and applied grammar. An anthology of modern prose for intensive study; a book of biographies for general reading.

Section B

English Reading, Comprehension, Paragraph Writing and applied grammar, Use of articles, pronouns; conjunctions and prepositions; position and order of adverbs; tenses; paragraph writing. Comprehension of unseen passages. A special question in lieu of translation for foreign students.

Reference Books:-

1. Andrew Strauss, (1996), "*An anthology of modern prose"*, Macmillan London.
2. Wren & Martin,(2005) "*English Grammar and Composition*" BLACKIE.
3. SC Gupta,(2012) "*English Grammar and Composition*", Arihant.

The mapping of PO/PSO/CO attainment is as follows:-

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3

CO1	1	1	2	2	-	2	1	1	1	3	2	1	2
CO2	2	1	1	1	3	1	3	1	3	2	-	2	3
CO3	3	1	-	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	3	3	-	1	1	3	-	-	1	2	1	1
Average	**2.2**	**1.6**	**1.7**	**1.5**	**1.7**	**1.8**	**2**	**1.7**	**1.7**	**2.2**	**2.2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Numerical Methods
Course Code: A610501
Semester 5th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Characterize the Basic concepts of operators like Solution of algebraic and transcendental equations: Bisection method, False position method, Fixed-point iteration method,
CO2	Solve problems using Newton forward formula and Newton backward formula and its convergence.
CO3	Derive Gauss's formula and Stirling's formula using Newton forward formula and Newton backward formula.
CO4	Calculate Simpson's 1/3, 3/8 rules using trapezoidal rule and evaluate the summation of series finite difference techniques

Credits 03

L T P
3 0 0

Course Contents

Unit - I

Solution of algebraic and transcendental equations: Bisection method, False position method, Fixed-point iteration method, Newton's method and its convergence, Chebyshev method. Solution of system of non-linear equations by Iteration and Newton-Raphson method. Program in C for Bisection method, False position method and Newton's method.

Unit - II

Finite difference operators and finite differences; Interpolation and interpolation formulae: Newton's forward and backward difference, Central difference: Sterling's and Bessel's formula, Lagrange's interpolation formula and Newton's divided difference interpolation formula, Hermite interpolation. Program in C for Newton's forward and backward formula, Newton's divided difference formula.

Unit - III

Direct methods to solve system of linear equations: Gauss elimination method, Gauss-Jordan method, LU decomposition; Indirect methods: Gauss-Jacobi and Gauss-Seidal methods. The algebraic eigen value problems by Householder and Power method.

Unit - IV

Numerical differentiation and Numerical integration by Newton cotes formulae, Trapezoidal rule, Simpson's rule, Romberg formula and their error estimation. Numerical solution of ordinary differential equations by Euler's method, Picard's method, Taylor series and Runge-Kutta methods.

Reference Books:

1. B. Bradie, (2007). *A Friendly Introduction to Numerical Analysis*, Pearson Education, India,

2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, (2007). *Numerical Methods for Scientific and Engineering Computation*, New age International Publisher, India, 5th edition,

3. C. F. Gerald and P. O. (2008). Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 7th edition.

4. M. Pal (2007). *Numerical Analysis for scientific and engineering computation*, Narosa Publication

5. N. Ahmad (2008). *Fundamental Numerical Analysis with error estimation*, Anamaya Publisher

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2	2	2	2	2	2	3	2
CO2	3	2	2	3	2	2	2	2	2	3	2	2	3
CO3	2	2	3	2	1	-	1	-	2	3	3	2	3
CO4	3	2	2	2	2	2	-	2	-	3	2	2	3

Average	**2.5**	**2**	**2.5**	**2.25**	**1.5**	**2**	**1.6**	**2**	**2**	**2.75**	**2.25**	**2.25**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Elective – I

Course Name: Co-ordinate Geometry II
Course Code: A610502
Semester 5th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Describe the various forms of equation of a plane, straight line, parabola, Ellipse and hyperbola.
CO2	Compare and contrast the geometries of the Euclidean and hyperbolic planes, and Analyze axioms for the Euclidean and hyperbolic planes and their consequences,
CO3	Find the angle between planes, Bisector planes, Perpendicular distance from a and Derive the point to a plane, Image of a line on a plane, Intersection of two lines
CO4	Use transformational and axiomatic techniques to prove theorems and Calculate the Shortest distance between two skew lines and Define co planar lines and illustrate

Course Contents

Credits 03 **L T P**
3 0 0

Unit - I

Conic:General equation of a conic, tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of mid-point, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola

Unit - II

Conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola. Identification of conic in general second degree equations. Equation of sphere, Tangent plane, Plane of contact and polar plane, Intersection of two spheres.

Unit - III

Radical plane, Coaxial spheres, Conjugate systems, Equation of a cone, Intersection of cone with a plane and a line, Enveloping cone, Right circular cone. Equation of cylinder, Enveloping and right circular cylinders, Equations of central conicoids

Unit - IV

Tangent plane, Normal, Plane of contact and polar plane, Enveloping cone and enveloping cylinder, Conjugate diameters and diametral planes, Equations of paraboloids and its simple properties.

Reference Books:

1. Loney, S. L. (1897). *The elements of coordinate geometry*. Macmillan and Company.
2. Jain,P.K. And Ahmad, K. (1994). *A Text Book of Analytical Geometry of two Dimensions*, Wiley Eastern Ltd.
3. Bell,R. J.T. (1994) . *Elementary Treatise on Coordinate Geometry of Three Dimesions*, Macmillan India Ltd.,
4. J. P. Mohindru, Mrs. Usha Gupta & A. S. Dogra (2004). *New Pattern Vector Algebra and Geometry*, International Publishers, New Edition.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	2	2	2	3	2	3	3
CO2	3	2	2	3	2	2	2	2	1	2	2	2	2
CO3	2	3	3	3	1	-	2	-	1	2	2	2	2
CO4	3	2	3	3	2	2	-	2	1	3	2	-	3
Average	**2.5**	**2.25**	**2.5**	**2.75**	**1.5**	**1.6**	**2**	**2**	**1.2**	**2.5**	**2**	**2.3**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Elective – I
Course Title: Group Theory
Course Code: 610514
Semester- 5th

Credits 03
Course Learning Outcomes:

On completion of this course, the successful students will be able to:

L T P

3 0 0

CO	Statement
CO1	Explain the basic theorems and their proofs, demonstrate when a binary algebraic structure forms a group, construct Cayley tables, determine possible subgroups of a group, identify normal subgroups of a group, examine symmetric and permutation groups, explain group and subgroup orders using Lagrange's theorem, identify cyclic subgroups and their generators, identify factor group etc.
CO2	Extend group structure to finite permutation groups By Cayley Hamilton Theorem and automorphism group
CO3	Generate groups under given specific conditions, implement group axioms, apply a range of mathematical techniques to solve a variety of quantitative problems and analyse and solve problems individually.
CO4	Apply definitions and theorems to solve problems in Group Theory, and prove new theorems.

Course Content

UNIT-I

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.

UNIT-II

Group automorphisms, inner automorphisms. Automorphism groups and their computations. Conjugacy relation. Normalizer. Counting principle and the class equation of a finite group. Center of a group. Free abelian groups. Structure theorem of finitely generated abelian groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.

UNIT-III

Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations,properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

UNIT-IV

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis.

SUGGESTED READINGS:-

1. John B. Fraleigh.(2002).*A First Course in Abstract Algebra*. 7th Ed., Pearson.
2. M. Artin .(2001). Abstract Algebra 2nd Ed., Pearson.
3. Joseph A. Gallian.(1999). *Contemporary Abstract Algebra*,4thEd.,NarosaPublishingHouse,New Delhi.
4. Joseph J. Rotman.(1995). *An Introduction to the Theory of Groups* 4th Ed., Springer Verlag.
5. I.N. Herstein (1975) *Topics in Algebra*Wiley Eastern Limited, India.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2	2	2	2	2	2	3	2
CO2	3	2	2	3	2	2	2	2	2	3	2	2	3
CO3	2	2	3	2	1	-	1	-	2	3	3	2	3
CO4	3	2	2	2	2	2	-	2	-	3	2	2	3
Average	**2.5**	**2**	**2.5**	**2.25**	**1.5**	**2**	**1.6**	**2**	**2**	**2.75**	**2.25**	**2.25**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Number Theory
Course Code: A610503
Semester 5th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Define and interpret the concepts of divisibility, congruence, the greatest common divisor, prime, and prime-factorization,
CO2	Express the concepts and results of divisibility of integers effectively and solve challenging problems related to Chinese remainder theorem effectively
CO3	Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues,
CO4	Demonstrate the logics and methods behind the major proofs in Number Theory and Describe the properties of prime numbers

Credits 03 **L T P**
3 0 0

Course Contents

Unit - I

Divisibility,Introduction, The Division Algorithm, GCD and LCM, The Euclidean Algorithm, Primes and their properties, Infinitude of primes.

Unit - II

The Fundamental Theorem of Arithmetic, The Prime Number Theorem (statement only). Congruence - Definition and properties of it, Solutions of Congruence, Euler's phi function.

Unit - III

Fermat's Theorem, Euler's Theorem, Wilson's Theorem, The Chinese Re-mainder Theorem, Multiplicative property of Euler's phi function, Primitive Roots.

Unit - IV

Quadratic Reciprocity,Quadratic Residues, The Legendre Symbol and its proper-ties, Lemma of Gauss, The Gaussian Reciprocity Law, The Jacobi symbol. Arithmetic functions $\mu(n)$, $d(n)$, $\Phi(n)$, $\sigma_\alpha(n)$, Mobious inversion formula.

Reference Books:-

1. G. H. Hardy and E. M. Wright, (2008). *An Introduction to Theory of Numbers*, Oxford University Press, 6th Ed ,
2. I. Niven, H. S. Zuckerman and H. L. Montgomery, (2004). *An Introduction to the Theory of Numbers*, John Wiley and Sons, (Asia) 5th Ed.,
3. H. Davenport, (1999). *The Higher Arithmetic*, Camb. Univ. Press, 7th edition,
4. David M. Burton, (2007). *Elementary Number Theory*, Tata McGraw Hill, 6th Edition,
5. Hardy, G. H., and Wright, E. M., (1979). *An Introduction to the Theory of Numbers*, 5th Edition, Clarendon Press (Oxford),

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	2	2	2	1	2	2	2	2
CO2	2	2	3	2	2	2	-	2	2	3	3	3	2
CO3	3	3	2	2	1	1	2	2	-	2	2	2	2

CO4	2	2	3	2	1	-	1	-	2	3	-	2	3
Average	**2.5**	**2.25**	**2.75**	**2.25**	**1.5**	**1.6**	**1.6**	**2**	**1.6**	**2.5**	**2.3**	**2.25**	**2.25**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:Condensed Matter Physics-I
Course Code:-A610504
Semester: 5th

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	List the crystal structures in one, two and three dimensional and structures of bravais lattices.
CO 2	Define the different techniques and methods for crystal structure analysis and to find out the packing fractions of different structures.
CO 3	Describe the interior of the substances using X-ray diffraction in crystals and reciprocals of SC, BCC and FCC.
CO 4	Test theoretical basis of experimental material science and technology, structures of diamond and Nacl.
CO 5	Solve problems of Crystal planes, Miller indices, Laue equations and Brillouin zones.

Course Contents

SECTION A

Crystal structure : General definitions of Lattice, basis and primitive cell, Symmetry operations for a two dimensional crystal. Bravais lattices in two and three dimensions, Index system for crystal planes, Structure of common lattice types (scc, fcc, bcc, hcp, diamond, NaCl, CsCl&Zns structures).

SECTION B

Reciprocal Lattice: Reciprocal Lattice, Brillouin zone of scc, fcc and bcc lattices, atomic form factor, structure factor of simple structures (sc, fcc, bcc, hcp, diamond, NaCl, CsCl&Zns)

SECTION C

Crystal diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Neutron and electron diffractionmethods,

SECTION D

Crystal Binding : Various types of binding, crystals of inert gases, Vander- Waals-London interactions. Lenard-Jones potential, Ionic crystals, Madelung constant.

REFERENCE BOOKS

1. C. Kittel(2003), *Introduction to Solid State Physics* (Wiley Eastern).
2. S.H. Patil (1985), *Elements of Modern Physics* TMGH
3. Puri and Babbar(1998), *Solid State Physics*, MGH Co.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	-	3	1	3	3	1	-	3	2	1	2
CO2	2	3	1	1	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	-	1	2	1	-	2	2	3	2	2
CO5	3	1	3	3	-	1	3	2	3	-	2	1	1
Average	**2.2**	**1.8**	**2**	**2.2**	**1.7**	**2**	**2.4**	**1.7**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Electronics and Solid State Devices-I
Course Code:-A610505
Semester: 5th

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Demonstrate the basic concepts of the diode ,its applications, relationship between semiconductors devices and applications.
CO 2	Explain how to construct a transistor amplifier and how its gain varies with frequency,Concepts of the filter circuits and their application to reduce the ripple factor.

CO 3	Differentiate bipolar and unipolar devices and different types of biasing used for their stability.
CO 4	Analyze the depth of CB and CE characteristics, Structure of JFET and MOSFET,Transistor biasing and stabilization of operating point.
CO 5	Design and verification of electronic devices and systems which will increase their employability scope in various electronics related companies.

Course Contents

SECTION A

Diodes: Concepts of current and voltage sources, p-n junction, Biasing of diode, V-A characteristics. Zener diode. LED, Low Capacitance Diode

SECTION B

Rectifier and filters: half wave, full wave rectifiers and bridge rectifiers, Qualitative analysis of Filter circuits (RC LC and π filters), Efficiency, Ripple factor, Voltage regulation. Voltage multiplier circuits.

SECTION C

Junction transistor and its biasing :Structure and working, relation between different currents in transistor, Sign conventions. Amplifying action, Different configurations of a transistor and their comparison. CB and CE characteristics, Transistor biasing and stabilization of operating point, Fixed bias, Collector to base bias, Bias circuit with emitter resistor, Voltage divider biasing circuit.

SECTION D

JFET and OP-AMP: Structure of JFET and MOSFET,OP AMP and its characteristics and applications

.

REFERENCE BOOKS

1. N.N. Bhargave, D.C. Kulshreshtha and S.C.Gupta ((1 July 2017), *Basic Electronics and linear Circuits*, McGraw Hill Education; 2nd edition
2. D. Chatopadhyay, P.c. Rakshit, B. Saha and N.N. Purkit(2001), *Foundations of Electronics*, New Age International (P) Ltd.
3. D.C. Tayal(2003) ,*Basic Electronic* (Himalaya Pub.)

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	2	2	3	1	1	1	1	-	3	2	1	2
CO2	2	1	-	1	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	-	1	1	2	3	3
CO4	2	2	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	3	3	-	1	3	2	3	-	2	1	1
Average	**2.2**	**2**	**2.2**	**2.2**	**1.7**	**1.8**	**2**	**1.5**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Nuclear and Particle Physics-I

Course Code:-A610506
Semester: 5th

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Analyze the ideas of basics of nucleus, Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, and energy.
CO 2	Explain about the general properties of nuclei, nuclear forces and detectors, radioactive decay and nuclear reactions.
CO 3	Examine the liquid drop model. Semi-empirical mass formula, Conditions of nuclear stability, Fermi gas model. Nuclear shell modelto explain the nucleus structure
CO 4	Categorize the different types of the radioactive decay and kinetics of nuclear reactions, Evidence of existence of neutrino, Qualitative discussion of alpha and beta decay theories, Nuclear reactions. Reaction cross section, Conservation laws. Kinematics of nuclear reaction, Q-value and its physical significance.
CO 5	Builds a foundation for the students to carry out research in the field of nuclear physics, high energy physics, nuclear astrophysics, nuclear reactions and applied nuclear physics.

Course Contents

SECTION-A

Nuclear Properties : Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge. Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, Wave mechanical properties of nucleus, Average binding energy and its variation with mass numbers.

SECTION-B

Nuclear Models: Properties of nuclear forces and saturation, Non existence of electrons in the nucleus and neutron-proton model, Yukawa theory, Assumptions of liquid drop model. Semi-empirical mass formula, Conditions of nuclear stability, Fermi gas model. Nuclear shell model.Experimentalevidence of magic numbers and its explanation.

SECTION-C

Radioactivity decays : Modes of decay and successive radioactivity. Alpha emission.Electron emission, Positron emission. Electron capture, Gamma-ray emission, Internal conversion, Qualitative discussion of alpha, beta and gamma spectra, Geiger-Nuttal rule, Neutrino hypothesis of beta decay, Evidence of existence of neutrino, Qualitative discussion of alpha and beta decay theories.

SECTION-D

Nuclear reactions: Reaction cross section, Conservation laws. Kinematics of nuclear reaction, Q value and its physical significance,Compound nucleus, Possible reaction with high energy particles.

REFERENCE BOOKS:

1. M.R. Bhiday and V.A. Joshi(2002) , *An Introduction to Nuclear Physics*, Orient Longman
2. D.C. Tayal (2001), *Introductory Nuclear Physics*, Himalaya Pub.
3. I. Kaplan(2003), *Nuclear Physics*, Addision-Wiley Pub. Co. Inc.
4. Bucham(1965), *Nuclear Physics*, Indian Ed.

The mapping of PO/PSO/CO attainment is as follow:-

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	1	2	2	-	2	1	1	1	3	2	1	2
CO2	2	1	1	1	3	1	3	1	3	2	-	2	3
CO3	3	1	-	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	3	3	-	1	1	3	-	-	1	2	1	1
Average	**2.2**	**1.6**	**1.7**	**1.5**	**1.7**	**1.8**	**2**	**1.7**	**1.7**	**2.2**	**2.2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: INORGANIC CHEMISTRY - V

Course Code: 610507

Semester: 5th

Credits: 02

L	**T**	**P**
2	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	Use of Crystal Field Theory to understand the magnetic properties and color of Co-ordination compounds.
CO2	Describe the key features of coordination compounds including variety of structures, oxidation no. and electronic configuration, coordination no., ligands, chelates, bonding

	And stability of complexes.
CO3	Study the types of isomerism in coordination compounds.
CO4	Discuss the synthesis, reactivity, aromatic character and importance of heterocyclic with More than two hetero atoms.
CO5	Analyze the types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states.

COURSE CONTENT

SECTION-A

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.

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.

SECTION –B

Magnetic Properties of Transition Metal Complexes types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μ_S and μ_{eff} values.Electronic Spectra of Transition Metal Complexes.Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, and spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complexion.

REERENCE Books:

1. *Inorganic Chemistry.* D.E. Shriver, P. W. Aikins and C.H. Langford.<Oxford.
2. W. W. Porterfield , (2005), *Inorganic Chemistry.* Addison. Wesley
3. . G.L. Miessler and O.A. Tarr *(2004), Inorganic Chemistry*, PrenticeHall.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3

CO1	1	1	2	2	-	2	1	1	-	3	2	1	2
CO2	2	1	1	1	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	-	1	2	1	2	2	2	3	2	2
CO5	3	3	3	3	1	1	3	-	3	-	2	1	1
Average	2.2	1.6	2	2	1.7	1.8	2	1.7	2.2	1.7	2	1.8	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: ORGANIC CHEMISTRY - V

Course Code: 610508

Semester: 5th

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	Interpret spectra (IR, ^{1}H NMR, ^{13}C NMR, Mass Spec. and UV-Visible) of Organic molecules.
CO2	Elucidate the structure of organic molecules from spectral data.

CO3	Draw similarities and differences between Spectrometry and Spectroscopy.
CO4	Discuss Organic synthesis in aqueous phase and ionic liquids.
CO5	Provides exposure to student for upcoming R&D vital in industries.

COURSE CONTENT

SECTION-A

Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, 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.

Electromagnetic spectrum: AbsorptionSpectra

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis of UV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

SECTION - B

III infrared (IR)

Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organiccompounds.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR, and PMR spectroscopic techniques.

Organo metallic Compounds

Organo magnesium Compounds, Grignard reagents formation, structure and chemical reactions. Organo zinc compounds: formation and chemical reactions.

Organo lithium compounds: formation and chemical reactions.

Organo Sulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers,

REFERENCE BOOKS :

1. AI, V. Furniss BS. Hannaford AJ. Smith PWG. Tatchell AR. *Vogel's Textbook of Practical Organic Chemistry*, 1920.
2. Ahluwalia, V. K., & Aggarwal, R. (2001). *Comprehensive practical organic chemistry: preparation and quantitative analysis*. Universities Press.
3. Ahluwalia, V. K., & Dhingra, S. (2004). *Comprehensive Practical Organic Chemistry: Qualitative Analysis*. Universities Press.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	2	2	-	2	1	-	1	3	2	1	2
CO2	2	2	1	3	3	1	3	1	3	2	1	2	3
CO3	3	3	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	-	1	1	2	1	2	2	2	3	2	2
CO5	3	3	2	-	-	1	3	2	-	1	2	1	1
Average	**2.2**	**2.6**	**2**	**2**	**1.5**	**1.8**	**2**	**2**	**1.7**	**2.2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHYSICAL CHEMISTRY - V

Course Code: 610509

Semester: 5th

Credits: 02	**L**	**T**	**P**
	2	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will able to:

CO	**Statement**
CO1	Identify, select and explain the concepts involved in theoretical framework of quantum Mechanics.
CO2	Describe the quantum mechanical behavior of simple system such as: Particle in box, Harmonic Oscillator etc.
CO3	Derive the information on molecular methods (IR, Raman and UV Visible etc.).
CO4	Interpret rotational and vibrational spectrum.
CO5	Use the idea of vibrational frequencies of different functional groups.

COURSE CONTENT

Elementary Quantum Mechanics

SECTION-A

Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids. 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.

SECTION-B

Spectroscopy Introduction:

Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum:

Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, 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 an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Reference Books:

1. Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. TataMcGraw-Hill: New Delhi(2006).
2. Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill(2001).
3. House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA(2004).
4. Kakkar, R. *Atomic & Molecular Spectroscopy*: *Concepts & Applications*, Cambridge University Press(2015).
5. Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press(2005).

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	-	2	3	2	1	1	1	3	2	1	2
CO2	2	2	1	3	3	1	3	-	3	2	1	2	3
CO3	3	3	3	-	2	3	2	3	-	-	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	1	2	1	1
Average	2.2	2.6	1.7	2.2	2.2	1.8	2	2	2.2	2	2	1.8	2.2

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHYSICS – V Lab

Course Code: 610510

Semester: 5th

L T P

Credits:02 **0 0 4**

Course Outcomes: On successful completion of this course, the students will able to::

CO	Statement
CO1	Acquire the appropriate data accurately and keep systematic record of laboratory activities
CO2	Interpret findings using the correct physical scientific framework and tools.
CO3	Prepare professional quality textual and graphical presentations of laboratory data and computational results
CO4	Evaluate possible causes of discrepancy in practical experimental observations, results in comparison to theory
CO5	Describe the physical and electronic properties of inorganic compounds such as metals, ionic solids, coordination compounds and nonmaterial.

COURSE CONTENT

LIST OF EXPERIMENTS

1. Measurement of reverse saturation current in p-n junction diode at various temperatures and to find the approximate value of energy gap.

2. To draw forward and reverse bias characteristics of a p-n junction diode and draw a load line.

3. To study the response of RC circuit to various input voltages (square, sine and triangular).

4. To measure the efficiency and ripple factors for (a) Half-wave (b) full wave and (c) bridge rectifier circuits

5. To study the reduction in the ripples in the rectified output with RC. LC and filters.

6. To draw the characteristics of a Zener diode.

7. To study the stabilization of output voltage of a power supply with Zener diode.

8. To plot Common Emitter Characteristics of a transistor (pnp or npn)

9. To plot Common Base Characteristics and determine h-parameters of a given transistor.

10. To draw the plateau of a GM counter and find its dead time.

11. To study the statistical fluctuations and end point energy of beta particles using GM counter.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	2	3	2	1	1	1	-	2	1	2
CO2	2	2	1	3	3	1	3	1	3	2	1	2	3
CO3	3	3	3	-	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	-	2	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	1	2	1	1
Average	**2.4**	**2.6**	**1.7**	**2.2**	**2.2**	**1.8**	**2**	**1.7**	**2.2**	**1.5**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Chemistry – V Lab Course

Code: 610511

Semester: 5th

L T P

Credits:02 **0 0 2**

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	State and apply the laws of thermodynamics; perform calculations with ideal and real gases; design practical engines by using thermodynamic cycles; predict chemical Equilibrium and spontaneity of reactions by using thermodynamic principles.
CO2	Apply the concepts of colloids and gels
CO3	Acquire skills in handling and measurement of radioactive material.
CO4	Demonstrate the methods for measurements of radioactivity
CO5	Analyze the of m-nitroaniline from m-dinitrobenzene

COURSE CONTENT

(a) Preparation of sodium trioxalatoferrate (III), $Na_3[Fe(C_2O_4)_3]$ and determination ofits composition bypermagnometry.
(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]^{2+}$
(c) Preparation of copper tetra-ammine complex. $[Cu(NH_3)_4]S0_4$.
(d) Preparation of cis-and trans-bis (oxalato)diaquachromate(III)ion.

Synthesis or Organic Compounds

(a) Iodoform from ethanol andacetone
(b) Aromatic electrophlicsubstitution

1. m-dinitrobenzene
2. p-nitroacetanilide
3. p- bromoacetanilide 2, 4,6 –Tribromophenol Diazotization/Coupling.
4. Preparation of methyl orange and methylred
5. Preparation of benzoic acid fromtoluene
6. Reduction

Preparation of aniline from nitrobenzene

Preparation of m-nitroaniline from m-dinitrobenzene.

Reference books:

1. Svehla,,(2004), *Vogel's Qualitative Inorganic Analysis*, revised, Orienl PLongman.
2. J.Bassett, R. C.Denney, G.H. Jeffery and J. Mendham, *(2005) Vogel's Text book of Quantitative Inorganic Analysis* (revised), ELBS

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	2	3	2	1	-	1	-	2	1	2
CO2	2	2	1	3	3	1	3	1	3	2	1	2	3
CO3	3	3	3	2	-	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	-	2	3	2	2
CO5	3	3	2	3	1	1	3	2	3	1	2	1	1
Average	**2.4**	**2.6**	**1.7**	**2**	**2**	**1.8**	**2**	**2**	**2**	**1.5**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Fundamentals of Computer

Course Code: 610512

Semester: 5th

Credits 03 **L T P**
3 0 0

Course Outcomes:-

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Converse in basic computer terminology
CO2	Formulate opinions about the impact of computers on society
CO3	Possess the knowledge of basic hardware peripherals
CO4	Know and use different number systems and the basics of programming

Introduction to Computers, Anatomy of Computers, Input and Output Devices. Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines. Disk Operating System (DOS): Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. Applications – MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and saving a spreadsheet with MSEXCEL

Reference books:-

1. Pradeep K Sinha; Priti Sinha,(2005), *data Processing and Computer Sciences*, New Delhi : BPB Publications.

3. **John monyjok Maluth,(2008), *Basic computer knowledge, Willy Publication.***

]The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3

CO1	3	3	-	2	3	2	1	1	1	-	2	1	2
CO2	2	2	1	3	3	1	3	1	3	2	1	2	3
CO3	3	3	3	-	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	-	2	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	1	2	1	1
Average	**2.4**	**2.6**	**1.7**	**2.2**	**2.2**	**1.8**	**2**	**1.7**	**2.2**	**1.5**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Metric Space
Course Code: 610601
Semester 6th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Comprehend the concepts of countable spaces ,separable spaces, open spheres and closed spheres, Neighbourhood of a point, Open sets, limit points ,Interior points, Limit points
CO2	Apply the properties of open sets, close sets, interior points, accumulation points and derived sets in deriving the proofs of various theorems.
CO3	Construct topological spaces from metric spaces and using general properties of Neighbourhoods, open sets, close sets, basis and sub-basis.
CO4	Recognize the concepts and properties of the compact and connected topological spaces. Define the structure of locally-convex topological vector spaces.

Course content

Credits 03 **L T P**
3 0 0

Unit-1

Definition and examples of metric spaces, open spheres and closed spheres, Neighbourhood of a point, Open sets, limit points ,Interior points, Limit points, Closed sets and closure of a set.

Unit-2

Boundary points, diameter of a set, Subspace of a metric space. Convergent and Cauchy sequences, Complete metric space, dense subsets and separable spaces,

Unit-3

Nowhere dense sets, Continuous functions and their characterizations, Isometry and homeomorphism.Compact spaces, Sequential compactness and Bolzano-Weierstrass property.

Unit-4

Finite Intersection property, Continuous functions and compact sets. Disconnected and connected sets, Components, Continuous functions and connected sets.

Reference Books:

1. G.F. Simmons (1963). *Introduction to Topology and Modern Analysis*, McGraw Hill,.

2. E.T. Copson, (1968). *Metric spaces*, Cambridge University Press,

3. P.K. Jain and Khalil Ahmad (2003). *Metric spaces*, Second Edition, Narosa Publishing House, New Delhi,

4. B. K. Tyagi, (2010). *First course in metric spaces*, Cambridge University Press,

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	2	2	2	2	3
CO2	2	2	2	2	2	2	2	2	2	2	2	2	3
CO3	3	3	3	2	1	1	-	1	2	3	2	3	3
CO4	2	3	2	3	2	-	2	-	-	2	1	2	2
Average	**1.3**	**2.5**	**2.25**	**2.25**	**1.75**	**1.3**	**2**	**1.6**	**2**	**2.25**	**1.75**	**2.25**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Complex Analysis
Course Code: 610602
Semester 6th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	**Statements**

CO1	Apply the concept and consequences of analytical equations and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra.
CO2	Use differentiation rules to compute derivatives and express complex- differentiable functions as power series.
CO3	Identify the isolated singularities of a function and determine whether they are removable, poles or essential.
CO4	Comprehend the geometric representation of complex number. Compute line integrals by using Cauchy's integral theorem and formulas.

Course Content

Credits 03 **L T P**
3 0 0

Unit-1

Complex numbers as ordered pairs, Geometrical representation of complex numbers, stereographic projection, Limit and continuity, Complex derivative, Derivative and Analyticity, analytic functions, Cauchy-Riemann equations, Harmonic equations.

Unit-2

Elementary functions, Exponential functions, Trigonometric functions, Hyperbolic functions, Logarithmic functions, Analyticity of Log functions, Inverse trigonometric and Hyperbolic functions. Mapping by elementary functions, Mobius Transformations, Fixed points, Cross ratio, Inverse points and critical mappings, Conformal mappings.

Unit-3

Integration of complex-valued functions, Contours, Contour integrals, Anti derivatives, Cauchy Theorem (without proof), Simply and multiply connected regions, Cauchy integral formula (without proof), Line integration, Complex line integration, Contour integration and Green's theorem (without proof),.

Unit-4

Convergence of sequences and series, Taylor series, Laurent series, Maclaurin series. Path Independence, Indefinite Integrals, Fundamental theorem of calculus in the complex plane

Reference Books:

1. R. V. Churchill and J. W. Brown: (1990). *Complex Variables and Applications*, McGraw Hill Publishing Company,

2. E. Hille: (1973). *Analytic Functions Theory*, Vol. 2, Ginn and Co. 2nd Ed. New York,.

3. E. B. Saff and A. D. Snidder: (1999). *Fundamental of Complex Analysis with Applications to Engg. And Science*, Pearson Education.

4. A. David Wunsch, (2009). *Complex Variables with Applications*, Pearson Publication,

5. Punnuswamy, (2008). *An Introduction to Complex Analysis*, Narosa Publication.

The mapping for PO/PSO/CO attainment is as follows:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	1	2	2	1	2	2	2	3
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3
CO3	3	3	2	2	1	1	-	-	2	3	2	3	2
CO4	2	3	3	2	2	-	2	1	-	3	1	3	3
Average	**2.25**	**2.5**	**2.5**	**2.25**	**1.75**	**1.3**	**2**	**1.6**	**1.3**	**2.75**	**1.75**	**2.75**	**2.75**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:- Operations Research and Linear Programming
Course Code: A 610603
Semester 6th

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Describe the origin, Scope, development of Operations Research and use the scientific methods of Operation research.
CO2	Interpret the dual variables and perform sensitivity analysis in the context of economics problems as shadow prices, imputed values, marginal values, or replacement values and Explain the concept of complementary slackness and its role in solving primal/dual problem pairs,
CO3	Define how to formulate an LPP with linear constraints and identify a problem in your locality, formulate it as an LPP and **solve.**
CO4	Explain, how to maximize the profit, minimize the cost, minimize the time in transportation problem. For example, travelling salesman problem, Assignment problems.

Credits 03

L T P
3 0 0

Course Contents

Unit I

Operations Research (OR) and its Scope, Modeling in OR, Scientific Method in Operations Research, Linear Programming: Definition, mathematical formulation, standard form, Solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, redundancy, degeneracy, Solution of LP Problems - Graphical Method, Simplex Method.

Unit II

Transportation Problem, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method), Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Assignment Problem, Hungarian Method for Assignment Problem.

Unit III

Elementary inventory models, Replacement models, Group replacement problem, Sequencing theory, *m* machines and *n* jobs problem, Graphical method for sequence problem.

Unit IV

Game Theory, pure and mixed strategies, Saddle point, Two-Persons-Zero-Sum Game, Game with mixed strategies, Dominance rule, Graphical Method, Inter - relation between the theory of games and linear programming, Solution of game using Simplex method.

Reference Books:

1. Sharma, J. K. (2016). *Operations research: theory and applications*. Trinity Press, an impint of Laxmi Publications Pvt. Limited

2. J. K. Sharma, (2012). *Operations Research – Problems and Solutions*, Macmillian Pub.

3. G. Hadly (1975). *Linear Programming*, Narosa Publishing House

4. A. H. Taha, (25005). *Operations Research – An Introduction*. Prentice Ha

5. Hillier and Lieberman, (2017). *Introduction to Operations Research*, McGraw Hill.

The mapping for PO/PSO/CO attainment is as follows

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	2	2	1	1	2	2	2	3
CO2	2	3	3	2	2	2	2	-	2	3	2	3	2
CO3	3	3	2	2	1	-	-	2	-	3	2	3	3
CO4	2	2	3	3	2	2	2	1	2	3	2	2	2
Average	**2.25**	**2.75**	**2.75**	**2.5**	**1.75**	**2**	**2**	**1.3**	**1.6**	**2.75**	**2**	**2.5**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:Condensed Matter Physics-II
Course Code:-A610604
Semester: 6th

L T P
Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students should be able to:

CO 1	Acquire knowledge about the basic concept of the lattice vibration and the role of the phonon in heat conductivity.
CO 2	Analyze the concept and parameters of free electron gas in metals and their role in electrical conductivity.
CO 3	Explain the difference between metal, insulator and semiconductor and explain their band gaps using Kroning-Penney model.
CO 4	Analyze the Einstein and Debye models of specific heat, Free electron model of metals. Free electron
CO 5	Solve the practical problems and some mathematical expressions like Magnetic field effect in superconductors, Fermi levels in intrinsic and extrinsic semiconductors

Course Contents

SECTION A

Lattice Vibrations : Dynamics of monatomic and diatomic linear chains, optical and acoustic modes, concept of phonons, inelastic scattering of photons and neutrons by phonons, density of states (one & Three dimensions) Einstein and Debye models of heat capacity, thermal expansion.

SECTION B

Free Electron theory of Metals: Free electron model of metals. Free electron, Fermi gas and Fermi energy.

SECTION C

Band theory of solids: Kronig-Penney model. Metals and insulators, Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors

SECTION D

Superconductors: Superconductivity, Magnetic field effect in superconductors, BCS theory. Thermal properties of superconductors.

REFERENCE BOOKS

1. C. Kittel(2003), *Introduction to Solid State Physics* (Wiley Eastern).
2. S.H. Patil (1985), *Elements of Modern Physics* TMGH
3. Puri and Babbar(1998), *Solid State Physics*, MGH Co.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	2	1	2	3

CO3	3	1	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	-	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	-	2	1	1
Average	**2.2**	**2.2**	**1.8**	**2**	**1.7**	**1.8**	**2**	**2**	**2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name:Electronics and Solid State Devices-II

Course Code:-A610605
Semester: 6th

L T P
3 0 0

Credits: 03

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Explain the working of the transistor amplifier, Working of CE amplifier, Amplifier analysis using h-parameters
CO 2	Define the concept of the feedback in the amplifier and advantage if the negative feedback and Emitter follower as negative feedback circuit.
CO 3	Compare the basic principal of the oscillator and oscillations, LC oscillator (tuned collector, tuned grid, Hartley qualitative)
CO 4	Design the skills and verification of electronic devices and systems which will increase their employability scope in various electronics related companies.
CO 5	Justify time and frequency analysis of analog electronic circuits and signals both analytical and with simulations

Course Contents

SECTION A

Amplifiers: Working of CE amplifier, Amplifier analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier and its voltage gain

SECTION B

Feedback in Amplifiers: Feed back in amplifiers. Different types, Voltage gain, Advantage of negative feedback, Emitter follower as negative feedback circuit.

SECTION C

Oscillators: Barkhausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned grid, Hartley qualitative), RC oscillators. phase shift and Wein bridge,

SECTION D

Communication: Modulation and detection. AM and FM, Power in AM and generation of AM, AM detector, Radio transmitter, Radio wave propagation.Ionosphere, Radio receiver.TV receiver

REFERENCE BOOKS

1. N.N. Bhargave, D.C. Kulshreshtha and S.C.Gupta ((1 July 2017), *Basic Electronics and linear Circuits*, McGraw Hill Education; 2nd edition
2. D. Chatopadhyay, P.c. Rakshit, B. Saha and N.N. Purkit(2001), *Foundations of Electronics*, New Age International (P) Ltd.
3. D.C. Tayal(2003) ,*Basic Electronic* Himalaya Pub. New Age International (P) Ltd.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	-	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	-	2	1	1
Average	**2.2**	**2.2**	**1.8**	**2**	**1.7**	**1.8**	**2**	**2**	**2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Elective – I

Course Name: Nuclear& Particle Physics-II

Course Code:-610606

Semester: 6th

L T P

Credits: 03 **3 0 0**

Course Outcomes: On completion of this course, the successful students will be able to:

CO 1	Demonstrate the basic concepts of different types of cyclotron to accelerate the different type of charged particles.
CO 2	Analyze the different type of the detector and counters that are used for detection of the radiation.(Proportional counter, GM counter, Scintillation counter, Solid state detectors)
CO 3	Derive the concept of the quarks model and basic knowledge about the Standard Model of elementary particles and interactions.
CO 4	Build up a foundation for the students to carry out research in the field of nuclear physics, high energy physics, nuclear astrophysics, nuclear reactions and applied nuclear physics.
CO 5	Compare the roles of nuclear and particle physics in energy production, medicine, and astrophysics - for example how to search for dark matter and how to understand the origin of the elements in the universe.

Course Contents

SECTION -A

Radiation interaction with matter : Energy loss due to ionization (Bethe Block formula), Energy loss of electrons, Bremsstrahlung, Multiple Coulomb scattering, Gamma –ray through matter. Pair production ,Radiation loss by fast electrons. Radiation length , Electron – positron annihilation.

SECTION –B

Particle Accelerators : Cyclotron. Betatron, Qualitative discussion of Synchrotron, Collider machines and linear accelerator.

SECTION –C

Radiation Detectors : Ionization chamber, Proportional counter, GM counter, Scintillation counter, Solid state detectors.

SECTION – D

Elementary particles : masses of elementary particles, Decay modes,Classification of these particles,types of interactions. Conservation laws and quantum numbers,Concepts of isospin. Strangeness, Parity , Charge conjugation. Antiparticles,Gell Man method , Decay and strange Particles. Particle symmetry, introduction to quarks and qualitative discussion of the quark model.

REFERENCE BOOKS:

1. M.R. Bhiday and V.A. Joshi(2002), *An Introduction to Nuclear Physics*, Orient Longman
2. D.C. Tayal(1999), *Introductory Nuclear Physics*, Himalaya Pub.
3. Kaplan(2003), *Nuclear Physics*, Addision-Wiley Pub. Co. Inc.
4. Bucham(2002), *Nuclear Physics*, Indian Ed.
5. B.L. Cohen(1997), *Concepts of Nuclear Physics*,TMI Ed.
6. M.P. Khanna(2000) , *Particle Physics*, Prentice Hall of India

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----------The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	-	2	3	2	2
CO5	3	3	2	3	-	1	3	2	3	-	2	1	1
Average	**2.2**	**2.2**	**1.8**	**2**	**1.7**	**1.8**	**2**	**2**	**2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Elective – I

Course Name: Nano Science

Course Code: 610612

Semester: 6th

Credits: 03 **L T P**

3 0 0

Course Outcomes: On completion of this course, the successful students will be able to:

CO	Statements
CO1	Analyze the internal structure of materials, atoms and Crystals.
CO2	Conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
CO3	Demonstrate the application of diffusion in sintering and doping of semiconductors.
CO4	Interpret mechanical properties of materials and optical properties of Materials.

Course Content

SECTION- A

NANOSCALE SYSTEMS: Introduction to Nanoscale – Size-Dependent properties - Size effect - surface tension, wettability - specific surface area and surface area to volume ratio – Reason for change in optical properties, electrical properties and mechanical properties – nanoscale catalysis - Principles of Top-Down and Bottom-Up approaches.

SECTION- B

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Gas phase condensation – Vacuum deposition -Physical vapor deposition (PVD) - chemical vapor deposition (CVD) - Sol-Gel- Ball milling –spray pyrolysis – plasma

based synthesis process (PSP) - hydrothermal synthesis - Etching technologies: wet and dry etching - photolithography – Drawbacks of optical lithography for nanofabrication - electron beam lithography – ion beam lithography - dip-pen nanolithography.

SECTION- C

QUANTUM DOTS: Quantum confinement - Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- MOCVD and MBE growth of quantum dots - current-voltage characteristics - magneto tunneling measurements - Absorption and emission spectra of quantum dots - photo luminescence spectrum.

SECTION- D

APPLICATIONS OF NANOTECHNOLOGY: Nanodiodes, Nano switches, molecular switches, Nano-logic elements - Single electron transistors - small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors –Surface acoustic wave (SAW) devices, microwa**ves** MEMS, field emission display devices, - Super hard nanocomposite coatings and applications in tooling - Biochemistry and medical applications: lab-on-a-chip systems. Nanobot – nano submarines - DNA engineering.

Reference Books:

1. S. Shanmugam, "*Nanotechnology*", TBH Edition.
2. T. Praddetp, "*Nano- the essential*" , Mc graw hill education, Chennai.
3. , Kenneth J. Klabunde (2001), "*Nanoscale Materials*", Wiley & Sons, Publcn.

The mapping of PO/PSO/CO attainment is as follows

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	2	2	2	2	3	3
CO2	2	3	2	3	2	2	1	2	-	3	2	1	2
CO3	3	2	2	2	2	-	-	-	2	2	2	2	3
CO4	2	2	2	2	2	2	2	2	2	3	-	3	2
Average	**2.2**	**2.2**	**2**	**2.2**	**1.7**	**1.5**	**1.6**	**2**	**2**	**2.5**	**2**	**2.2**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: INORGANIC CHEMISTRY - VI

Course Code: 610607

Semester:6th

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to:

CO	Statement
CO1	Describe HSAB rule chelation, macro cyclic, crypt ate effect.
CO2	Discuss bonding modes of CO,NO, 18-electron rule , different bond lengths & frequencies of CO, NO
CO3	Differentprocesses involved in the storage and transport of metal ions.
CO4	Apply knowledge of electron transfer reactions and the role of metal ions in biological Systems.
CO5	Use Silicones and Phosphazenes as examples of inorganic polymers

COURSE CONTENT

SECTION-A

I. Hard and Soft acids and Bases(HSAB)

Classification of acids and bases as a hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

II. Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{+2}, Nitrogen fixation.

SECTION-B

III. Silicones and Phosphazenes

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

IV. Organ metallic Chemistry

Definition, Nomenclature and classification of organ metallic compounds. Preparation, properties, bonding and applications of alkyls, of' Li, Al, Hg, Sn and Ti, a brief account of metal- ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Reference Books:

1. Porterfield, W. W. (2013). *Inorganic chemistry*. Academic press.
2. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). Inorganic chemistry:
3. Principles of structure and reactivity. Pearson Education India.
4. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., & Grimes, R. (1988). Advanced inorganic chemistry ,New York: Wiley

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	2	2	1	2	1	3	1	3	2	1	2
CO2	1	2	1	1	3	1	3	1	-	-	1	2	3
CO3	3	1	-	2	-	3	2	3	-	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	3	2	3	1	1	3	2	3	1	2	1	1
Average	**2**	**2.2**	**1.5**	**1.8**	**1.5**	**1.8**	**2**	**2.2**	**1.5**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: ORGANIC CHEMISTRY - VI

Course Code: 610608

Semester:6th

Credits: 02

L	T	P
2	0	0

Course Outcomes:

On successful completion of this course, the students will able to::

CO	Statement
CO1	Make usage of heterocyclic compounds in pharmaceuticals, agrochemicals and veterinary Products.
CO2	Describe the immense chemistry constituting carbohydrates.
CO3	Estimate the number and average molecular weight /masses of polymers.
CO4	Apply knowledge of degree of polymerization on real life problems.
CO5	Analyze synthetic rubber on the large scale in the industries.

COURSE CONTENT

SECTION-A

I. Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piper dine and pyrrole.

Introduction to condensed five and six mamboed heterocyclic. Preparation and reactions of insole, quinolone and is quinolone with special reference to Fischer in dole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline andisoquinoline.

II. Synthesis of Polymers

Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Urea formaldehyde resins. Natural and synthetic rubbers.

III. Organic Synthesis Via Enolatcs

Acidity of α-hydrogen's, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl

acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate. Alkylation and acylation ofenamines.

SECTION - B

IV. Carbohydrates

Classification and nomenclature, Monosaccharide's, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.

Configuration of monosaccharide's. Erythro and threodiastereomers. 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, Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch and cellulose without involving structure determination.

V. Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structur, determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, Constituents of nucleic acids Ribonucleotides and ribonucleotides. The double helical structure of DNA.

Reference Books:

1. Morrison, R. T., & Boyd, R. N. (1987). Organic chemistry.
2. Finar, I. L. (1959). *Organic Chemistry*: The Fundamental Principles v.
3. Abernethy, J. L. (1957). Organic chemistry, Vol. II: Stereochemistry and the chemistry of natural products (Finar, IL).
4. Solomons, T. G., Fryhle, C. B., & Snyder, S. A. (2016). *Organic Chemistry, 12e Binder Ready Version Study Guide & Student Solutions Manual*. John Wiley & Sons.Sons.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	2	1	2	3

CO3	3	1	3	2	2	3	2	3	-	1	2	3	3
CO4	2	2	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	2	3	-	2	1	1
Average	**2.2**	**2**	**1.8**	**1.7**	**1.7**	**1.8**	**2**	**2**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHYSICAL CHEMISTRY - VI

Course Code: 610609

Semester:6th

Credits: 02

L	**T**	**P**
2	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will able to::

CO	**Statement**
CO1	Explain the crystal structure, parameters that effect crystal structures.
CO2	Use knowledge of lattice enthalpy of ionic compounds.
CO3	Explain the band structure of solids and determine their electrical properties.
CO4	Study the interaction of light with matter in terms of the relationship with the molecular Structure
CO5	Determine of crystal structure of NaCI, KCI and CsCI (Laue's method and powder method).

COURSE CONTENT

SECTION-A

I. Raman Spectrum:

Concept of polarizability, pure rotational and pure vibration Raman spectra of diatomic molecules, selection rules.

II. Electronic Spectrum:

Concept of potential energy curves for bonding and anti-bonding molecular orbital, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and n

Mouthier energy levels and their respective transitions.

III. Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry: Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples).

SECTION-B

IV. Solid State

Definition of space lattice and unit cell, Laws of crystallography-(i) Law of constancy of interfacial angles. (ii) Law of rationality of indices (iii) Law of symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCI, KCI and CsCI (Laue's method and powder method).

REFERENCE BOOKS (THEORY COURSES)

1. G.M. Barrow , *(2012), Physical Chemistry*, International Student edition, McGraw Hill.
2. C.N.R. Rao, (2019), *University General Chemistry*,. Macmillan.
3. R.A Alberty, (2003), *Physical Chemistry*, Wiley EasternLtd.
4. *Physical Chemistry*, R.A Alberty, Wiley EasternLtd.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	2	2	-	2	1	-	1	3	2	1	2
CO2	1	2	1	1	3	1	3	1	3	2	1	2	3
CO3	3	1	3	-	2	3	2	3	-	1	2	3	3
CO4	2	2	1	-	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	2	3	-	2	1	1
Average	**2**	**2**	**1.8**	**1.5**	**1.7**	**1.4**	**2**	**2**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation**.**

Course Name: Physics – VI Lab

Course Code: 610610

Semester: 6th

L T P

Credits:01 **0 0 4**

Course Outcomes: On successful completion of this course, the students will able to::

CO	Statement
CO1	Derive different types of atomic spectra
CO2	Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields
CO3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.
CO4	Comprehend the concept of phase space and its volume.
CO5	Interpret the phase diagrams of single component, multi-component systems

COURSE CONTENT

1. Study of a diode as a clipping element.
2. To measure the magnetic susceptibility of $FeCl_2$ solution by Quincke's method.
3. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
4. To draw output and mutual characteristics of an FET and determine its parameters.
5. To study the gain of an amplifier at different frequencies and to find band width and gain-band width product.
6. To set up an oscillator and study its output on CRO for different frequencies.
7. To study the characteristics of a thermistor and find its parameters.
8. To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.
9. To study the energy resolution and calibration of a scintillation counter.
10. To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	2	2	-	2	1	-	1	3	2	1	2
CO2	1	2	-	1	3	1	3	1	3	2	1	2	3
CO3	3	1	3	2	2	3	2	3	-	1	2	3	3
CO4	2	2	-	1	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	2	3	-	2	1	1
Average	**2**	**2**	**1.7**	**1.8**	**1.7**	**1.8**	**2**	**2**	**2.2**	**2**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: CHEMISTRY – VI Lab

Course Code: 610611

Semester: 6th

L T P

Credits:01 **0 0 2**

Course Outcomes: On successful completion of this course, the students will able to::

CO	Statement
CO1	Study the motion of viscous fluids by understanding Poiseuille‟s method.
CO2	Enable to understand the concept of magnetic field.

CO3	Apply the basic laws and concepts of dynamic bodies.
CO4	Use knowledge about the properties of materials.
CO5	Determine the molar refraction of methanol, ethanol and propanol.

COURSE CONTENT

Laboratory Techniques

1. ColumnChromatography
2. Separation of fluoresce in and methyleneblue.
3. Separation of leaf pigments from spinachleaves.
4. Models
   - Stereo chemical Study of Organic Compounds via Models
   - Rand S configuration of optical isomers.
   - E, Z configuration of geometrical isomers.
   - Conformational analysis of cyclohexanes and substituted cyclohexanes.
5. PhysicalExperiments

(a) To determine the strength of the given acid conduct metrically using standard alkalisolution.
(b) To determine the solubility and solubility product of a given sparingly solubleelectrolyte conductmetrically.
(c) To study the saponification of ethyl acetate conductmetrically.
(d) To determine the ionization constant of a weak acid conductmetrically.
(e) To determine the strength of the given acid solution pH- metrically by using standard alkali solution.
(f) To determine the molar refraction of methanol, ethanol and propanol.
(g) To study the distribution of iodine between water and$CC1_4$.
(h) To study the distribution of benzoic acid between benzene andwater.

REFERENCE BOOKS (LABORATORY COURSES)

1. Svehla,,(2004), *Vogel's Qualitative Inorganic Analysis,* revised, Orienl PLongman.
2. J.Bassett, R. C.Denney, G.H. Jeffery and J. Mendham, *(2005) Vogel's Text book of Quantitative Inorganic Analysis* (revised), ELBS
3. W. W. Scott , *(2005), Standard Methods of Chemical Analysis,* , The TechnicalPress.
4. W. G. Palmer , *(2004), Experimental Inorganic Chemistry,* ,Cambridge.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PSO	PSO	PSO

										0	1	2	3
CO1	1	3	2	2	1	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	-	1	2	3
CO3	1	1	3	2	2	-	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	2	-	1	2	1	1
Average	**1.8**	**2**	**1.8**	**2**	**1.6**	**1.5**	**2**	**2**	**1.7**	**1.7**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Environmental science

Course Code:-100302

Semester: 6th

L T P
3 0 0

Credits: 03

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statements
CO1	Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
CO2	Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
CO3	Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO4	Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.

COURSE CONTENTS

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies.

Disaster Management : Floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act.

Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies

REFERENCES/TEXT BOOKS

1. Agarwal, K. C. Environment Biology, Nidi Publ. Ltd. Bikaner.

2. Jadhav, H & Bhosale, V.M. Environment Protection and Laws. Himalaya Pub House, Delhi

3. Rao M. N. & Datta A.K. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.

The mapping of PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1	3	2	2	1	2	1	-	1	3	2	1	2
CO2	1	2	1	-	3	1	3	1	3	-	1	2	3
CO3	1	1	3	2	2	-	2	3	1	1	2	3	3
CO4	2	2	1	1	1	2	1	2	2	2	3	2	2
CO5	3	1	2	3	1	1	3	2	-	1	2	1	1
Average	**1.8**	**2**	**1.8**	**2**	**1.6**	**1.5**	**2**	**2**	**1.7**	**1.7**	**2**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Total Number of Course	73
Number of Theory Course	60
Number of Practical Course	13
Total Number of Credits	168

Annexure-4

Academic Instructions

Attendance Requirements

A student shall have to attend 75% of the scheduled periods in each course in a semester; otherwise he / she shall not be allowed to appear in that course in the University examination and shall be detained in the course(s). The University may condone attendance shortage in special circumstances (as specified by the Guru Kashi University authorities). A student detained in the course(s) would be allowed to appear in the subsequent university examination(s) only on having completed the attendance in the program, when the program is offered in a regular semester(s) or otherwise as per the rules.

Assessment of a course

Each course shall be assessed out of 100 marks. The distribution of these 100 marks is given in subsequent sub sections (as applicable).

	Internal (50)						**External (50)**	**Total**
Components	Attendance	A1	A2	A3	MST1	MST2	ETE	
Weightage	10	10	10	10	30	30	50	
Average Weightage	10	10			30		50	100

Passing Criteria

The students have to pass both in internal and external examinations. The minimum passing marks to clear in examination is 40% of the total marks.