CHOICE BASED CREDIT SYSTEM

SCHEME & SYLLABUS

B.Sc Non Medical

Department of Physical Sciences

University Institute of Sciences and Humanities (UISH)

Sant Baba Bhag Singh University

2020

ABOUT THE DEPARTMENT

The Physical Sciences expands our knowledge of the universe and underlines new technologies, which benefit our society. In keeping with the heritage of imparting quality education, teaching and research are the prime motive of the Department of Physical Sciences. Department of Physical Sciences is dynamic and progressive in its development of new course initiatives. The faculty is well placed to contribute substantially to the goal of SBBSU and becoming research-oriented organization. The teaching is by way of interactive sessions between students and teachers. Our courses ensure a coherent degree structure while encouraging interdisciplinary approach. The Department has highly qualified, young and dynamic faculty in various fields of Physical Sciences viz. in chemistry research interests include Green Chemistry, Polymer Chemistry, Advanced controlled drug delivery systems, Advanced heterocyclic chemistry etc. The thrust area in Physics includes Materials Physics, Condensed matter Physics, Nuclear Physics and nanomaterials and their applications. The research interests of faculty of mathematics include Numerical Analysis, Wavelet methods, topology, fixed point theory, qualitative behavior of dynamical systems. The outcome-based teaching model of faculty comprising of theoretical work, regular academic activities such as research projects, seminars, resource learning and hands-on laboratory work**.**

SALIENT FEATURES OF THE DEPARTMENT

- The department is blessed to have specialized faculty in various fields of Physical Sciences viz. Chemistry, Physics, Mathematics.
- The Department keeps its students abreast of latest advancements in technology through ultra-modern computer facilities, e-learning, virtual labs, SWAYAM Courses as per UGC guidelines.
- Elective courses that brides the gap between industry requirements and academia.
- The Department has well equipped laboratories with a number of instruments and facilities.

B.Sc(NON Medical)

B.Sc(Non medical) is a Technological realization of computer systems is the main objective of the program. The program ranges widely from creating standard professionals and research fellows who are working in almost all sectors of the world today. This course is fundamentally based on the basic principles of scientific studies namely Mathematics, Physics, Chemistry.

Vision

Be a leading educational institution in North India, with a responsibility towards societal betterment, a focus towards holistic growth and a multifaceted development centric approach.

Mission

To optimize and accelerate the effective and economical use of resources through concern, commitment, and care for the benefit of students and society.

Eligibility Criteria

10 + 2 or its equivalent examination with 50% marks in any stream conducted by a recognized college and university.

Duration

3 years

Career pathways

Areas that offer jobs for B.Sc. degree holder are: -Education, College, Universities, Healthcare providers, Hospitals, Research firms, Environmental management and conservation, forest services, chemical Industry, Biotechnology, Pharmaceutical companies, Geological Survey Department, Wastewater plants, Testing laboratories, Engineering firms, Oil Companies, Medical Laboratories, Food Institutes, Petroleum Companies, Power generating companies, Agricultural Research, Forensic Crime Research, Indian Civil Services etc.

- **Government Jobs**

  In the government sector, the top job posts for B.Sc. Non-medical students include Food inspectors, Government lab technicians, Clinical research, etc.

- **Corporate jobs**

  Multiple pathways designed according to the level of the students to prepare them for different job profiles as per needs of industrial sector.

- **Higher studies**

  After B.Sc(non medical) student can do B.Ed ,M.Sc, M.phill and PHD

- **Entrepreneurship**

  To set up new ventures

Programme Educational Objective (PEO)

PEO1. To impart quality education in basic physical sciences to achieve excellence in teaching-learning and Graduates will pursue higher studies in related fields.

PEO2. To provide hand on training which enable graduates to get employed in private/government institutions.

PEO3 . To construct a bridge between the theoretical and practical aspects of Physical Sciences & inculcate entrepreneur skills.

PEO4. To equip the learners to apply knowledge of Physical Sciences and to analyze the local and global impact of chemistry on individuals, organizations, and society.

PEO5. To develop employable skills and life time leaning .

Programme Outcomes (PO)(At the end of Programme/Degree mentioned above , the graduates will be able to ……)

PO1. Knowledge and understanding: Students will be able to understand specialised areas and explain major concepts in the Physical sciences and its applications.

PO2. Cognitive (thinking) skills: Students will be able to explain and apply the scientific method and develop strategies to solve mathematical problems, conducting experiments and testing hypotheses.

PO3 Practical skills: Student will be able to demonstrate the ability to read, understand, and critically review scientific information.

PO4 Graduate skills: Students will be able to motivate and communicate scientific knowledge in oral and written form accurately using a range of formats.

PO5 Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Programme Specific Outcomes (PSO)

PSO1. •Acquire knowledge and understanding of essential facts, concepts, principles and theories of physics, chemistry and Mathematics

PSO2. •Develop Skills to evaluate, analyse and interpret information and data.

PSO3 • Solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem.

PSO4 • Use standard laboratory equipments, modern instrumentation and classical techniques to carry out experiments and develop skills to interpret and explain the limits of accuracy of experimental data in terms of significance and underlying theory.

PSO5 • Think creatively (divergently and convergent) to propose novel ideas in explaining facts and figures or providing new solution to the problems.

ABOUT THE CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum-keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

1. Curriculum Structure: B.Sc(non medical) degree programme will have a curriculum with Syllabi consisting of following type of courses:

I. Ability Enhancement Courses (AEC): The Ability Enhancement Courses (AEC) may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). AECC courses are the courses based upon the content that leads to Knowledge enhancement; these are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc. A. Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication. B. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

II. Core Courses (CR): A course, which should compulsorily by studied by a candidate as a core requirement is termed as a Core course. These courses are employability enhancement courses relevant to the chosen program of study. Program core comprises of Theory, Practical, Project, Seminar etc. Project work is considered as a special course involving application of knowledge in solving/ analysing/exploring a real life situation/ difficult problem.

III. Elective Courses: Elective course is generally a course, which can be chosen from a pool of courses, and which may be very specific, specialized, advanced, or supportive to the discipline/subject of study or with provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill. Accordingly, elective course may be categorizes as: A. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

2. NOMENCLATURE USED:

A. Graduate Core Courses

i. core course (CR)

ii. Theory subject (T)

iii. Practical (P)

B. Ability Enhancement Courses (AEC):

i. Ability Enhancement Compulsory Courses (AECC)

ii. Skill Enhancement Courses (SEC).

C. Elective Courses (EL)

i. Discipline Specific Elective (DSE)

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	Skill enhancement courses			
22.	Physics workshop skills	**PHY205**	**III**	**62-63**
23.	Logics and sets	**MAT207**	**III**	**64**
24.	Basic Analytical chemistry	**CHM 209**	**III**	**65-66**
25.	Statistical Techniques with Excel	**MAT211**	**III**	**72**
26.	Electrical circuits and network skills	**PHY206**	**IV**	**67-68**
27.	Number theory	**MAT208**	**IV**	**69**
28.	Green Methods in Chemistry	**CHM 210**	**IV**	**70-71**
29.	Renewable and energy harvesting	**PHY309**	**V**	**73-74**
30.	Vector calculus	**MAT305**	**V**	**75**
31.	Fuel Chemistry	**CHM 313**	**V**	**76-77**
32.	Radiology and Safety	**PHY314**	**VI**	**78-79**
33.	Transportation and game theory	**MAT310**	**VI**	**80**
34.	Pharmaceutical Chemistry	**CHM 318**	**VI**	**81-82**
Ability Enhancement Compulsory Course				
35.	General English-I	**ENG 101**	**Semester-I**	**17-18**
36.	General Punjabi-I/HCP-I	**PBI 101/ HCP 101**	**Semester-I**	**19-21**
37.	General English-II	**ENG 102**	**Semester-II**	**31-32**
38.	General Punjabi-II/HCP	**PBI 102/ HCP 102**	**Semester-II**	**33-35**
39.	Environmental science	**EVS001**	**Semester-III**	**45-46**
40.	Gender Equity	**SSC001**	**Semester-IV**	**56**
41.	Human values and professional ethics	**SSC006**	**Semester-V**	**85**
42.	Communication Skills and Personality Development	**ENG004**	**Semester-VI**	**107**
	Discipline Subject Elective courses (semester-V,VI) Any two of each subject in both semesters			
43.	Digital, analog circuits and instrumentation	**PHY301**	**V**	**86-87**
44.	Digital, analog circuits and instrumentation (practical)	**PHY303**	**V**	**88-89**
45.	Elements of modern physics	**PHY305**	**V**	**90-91**
46.	Elements of modern physics (practical)	**PHY307**	**V**	**92-93**
47.	Matrices	**MAT301**	**V**	**94-95**
48.	Linear algebra	**MAT303**	**V**	**96-97**
49.	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	**CHM 305**	**V**	**98-99**
50.	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (practical)	**CHM 307**	**V**	**100-101**
51.	Industrial chemicals and Environment	**CHM 309**	**V**	**102-103**
52.	Industrial chemicals and Environment (practical)	**CHM 311**	**V**	**104-105**
53.	Solid state physics	**PHY302**	**VI**	**108-109**
54.	Solid state physics (practical)	**PHY304**	**VI**	**110-111**

COURSE CLASSIFICATION					
Ability Enhancement Compulsory Course		**L**	**T**	**P**	**Credits**
1	Environmental science	**3**	**0**	**0**	**3**
2	Communication Skills and Personality Development	**2**	**0**	**1**	**3**
3	Human values and professional ethics	**3**	**0**	**0**	**3**
4	Gender Equity	**3**	**0**	**0**	**3**
5	General English-I	**3**	**0**	**0**	**3**
6	General Punjabi-I/HCP	**3**	**0**	**0**	**3**
7	General English-II	**3**	**0**	**0**	**3**
8	General Punjabi-II/HCP	**3**	**0**	**0**	**3**
	Total credits				**24**
Core course(Theory and practical)		**L**	**T**	**P**	**Credit**
1	Mechanics	**4**	**0**	**0**	**4**
2	Differential Calculus	**6**	**0**	**0**	**6**
3	Atomic structures , bonding , general organic chemistry and aliphatic hydrocarbons	**0**	**0**	**4**	**2**
4	Atomic structures , bonding , general organic chemistry and aliphatic hydrocarbons(practical)	**0**	**0**	**4**	**2**
5	Mechanics(practical)	**0**	**0**	**4**	**2**
6	Electricity and Magnetism	**4**	**0**	**0**	**4**
7	Differential equations	**6**	**0**	**0**	**6**
8	Chemical energetic equilibria and functional group organic chemistry-I	**4**	**0**	**0**	**4**
9	Chemical Energetic Equilibrium and Functional Group Organic Chemistry-I (practical)	**0**	**0**	**4**	**2**
10	Electricity and magnetism (practical)	**0**	**0**	**4**	**2**
11	Thermal Physics and	**4**	**0**	**0**	**4**

	Statistical Mechanics				
12	Real Analysis	**6**	**0**	**0**	**6**
13	Solution, Phase Equilibrium, conductance Electrochemistry and Functional Group Organic chemistry -II	**4**	**0**	**0**	**4**
14	Solution, Phase Equilibrium, conductance electrochemistry and functional group organic chemistry- II (practical)	**0**	**0**	**4**	**2**
15	Thermal Physics and Statistical Mechanics (practical)	**0**	**0**	**4**	**2**
16	Waves and Optics	**4**	**0**	**0**	**4**
17	Algebra	**6**	**0**	**0**	**6**
18	Coordination chemistry, States of Matter & Chemical Kinetics	**4**	**0**	**0**	**4**
19	Coordination chemistry, States of matter & Chemical kinetics (practical)	**0**	**0**	**4**	**2**
20	Wave and optics(practical)	**0**	**0**	**4**	**2**
	Total credits				**70**
Skill Enhancement Subjects		**L**	**T**	**P**	**Credits**
1	Physics workshop skills	**2**	**0**	**0**	**2**
2	Logics and sets	**2**	**0**	**0**	**2**
3	Basic Analytical chemistry	**2**	**0**	**0**	**2**
4	Electrical circuits and network skills	**2**	**0**	**0**	**2**
5	Number theory	**2**	**0**	**0**	**2**
6	Green Methods in Chemistry	**2**	**0**	**0**	**2**
7	Renewable and energy harvesting	**2**	**0**	**0**	**2**
8	Statistical Techniques With Excel	**0**	**0**	**4**	**2**
9	Fuel Chemistry	**2**	**0**	**0**	**2**
10	Radiology and Safety	**2**	**0**	**0**	**2**

11	Transportation and game theory	**2**	**0**	**0**	**2**
12	Pharmaceutical Chemistry	**2**	**0**	**0**	**2**
13	Vector calculus	**2**	**0**	**0**	**2**
	Total credits				**26**
Discipline Specific Elective					
1	Digital, analog circuits and instrumentation	**4**	**0**	**0**	**4**
2	Digital, analog circuits and instrumentation (practical)	**0**	**0**	**4**	**2**
3	Elements of modern physics	**4**	**0**	**0**	**4**
4	Elements of modern physics (practical)		**0**	**4**	**2**
5	Matrices	**6**	**0**	**0**	**6**
6	Linear algebra				
7	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	**4**	**0**	**0**	**4**
8	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (practical)	**0**	**0**	**4**	**2**
9	Industrial chemicals and Environment	**4**	**0**	**0**	**4**
10	Industrial chemicals and Environment (practical)	**0**	**0**	**4**	**2**
11	Solid state physics	**4**	**0**	**0**	**4**
12	Solid state physics (practical)	**0**	**0**	**4**	**2**
13	Quantum mechanics	**4**	**0**	**0**	**4**
14	Quantum mechanics (practical)	**0**	**0**	**4**	**2**
15	Nuclear & Particle Physics	**4**	**0**	**0**	**4**
16	Nuclear & Particle Physics (practical)	**0**	**0**	**4**	**2**
17	Integral calculus	**6**	**0**	**0**	**6**
18	Complex analysis	**6**	**0**	**0**	**6**
19	Linear programming	**6**	**0**	**0**	**6**
20	Chemistry of main group elements,	**4**	**0**	**0**	**4**

	theories of acids and bases				
21	Chemistry of main group elements, theories of acids and bases (practical)	**4**	**0**	**0**	**4**
22	Green Chemistry	**4**	**0**	**0**	**4**
23	Green chemistry(practical)	**0**	**0**	**4**	**2**
24	Analytical method in chemistry	**4**	**0**	**0**	**4**
25	Analytical method in chemistry(practical)	**0**	**0**	**4**	**2**
	Total credits				**86**

Scheme for B.Sc. –Non Medical (CBCS)

Semester 1

I. Theory Subjects

S No.	Course Type	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	CR	PHY 101	Mechanics	4:0:0	4:0:0	4	4
2	CR	CHM 101	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4:0:0	4:0:0	4	4
3	CR	MAT 101	Calculus	6:0:0	6:0:0	6	6
4	AEC	ENG 101	General English-I	3:0:0	3:0:0	3	3
5	AEC	PBI 101/ HCP - 101	General Punjabi-I/HCP	3:0:0	3:0:0	3	3
6		PT101/PT103/PT 105	NSO/NCC/NSS	2:0:0	Non-credit	2	NC

II. Practical Subjects

1	CR	PHY103	Mechanics	0:0:4	0:0:2	4	2
2	CR	CHM 103	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	0:0:4	0:0:2	4	2
	Total					**30**	**24**

Total Contact Hours: 30

Total Credit Hours: 24

CR- Core Course

AEC-Ability Enhancement Compulsory Courses

Scheme for B.Sc. –Non Medical (CBCS)

Semester-II

I. Theory Subjects

S No.	Type of Course	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	CR	PHY 102	Electricity and Magnetism	4:0:0	4:0:0	4	4
2	CR	CHM 102	Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I	4:0:0	4:0:0	4	4
3	CR	MAT 102	Differential Equations	6:0:0	6:0:0	6	6
4	AEC	ENG 102	General English-II	3:0:0	3:0:0	3	3
5	AEC	PBI 102/ HCP 102	General Punjabi-II/HCP	3:0:0	3:0:0	3	3
6		PT102/PT 104/PT10 6	NSO /NCC/NSS/	2:0:0	Non-credit	2	NC

1	CR	PHY 104	Electricity and Magnetism	0:0:4	0:0:2	4	2
2	CR	CHM 104	Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I	0:0:4	0:0:2	4	2
			Total			**30**	**24**

Total Contact Hours: 30

Total Credit Hours: 24

CR- Core Course

AECC-Ability Enhancement Compulsory Courses

Scheme for B.Sc. –Non Medical (CBCS)
Semester-III

I. Theory Subjects

S No.	Type of Course	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	CR	PHY 201	Thermal Physics and Statistical Mechanics	4:0:0	4:0:0	4	4
2	CR	CHM 201	Solutions, Phase equilibrium, Conductance, Electrochemistry& Functional Group Organic Chemistry-II	4:0:0	4:0:0	4	4
3	CR	MAT 201	Real Analysis	6:0:0	6:0:0	6	6
4	CR	EVS 001	Environmental Science	3:0:0	3:0:0	3	3
5	SEC-1		Elective subject(Skill Enhancement Course)-I	2:0:0	2:0:0	2	2

1	CR	PHY 203	Thermal Physics and Statistical Mechanics	0:0:4	0:0:2	4	2
2	CR	CHM 203	Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II	0:0:4	0:0:2	4	2
						27	**23**

Total Contact Hours: 27

Total Credit Hours: 23

CR- Core Course

AEC-Ability Enhancement Compulsory Course
SEC-Skill Enhancement course

Scheme for B.Sc. –Non Medical (CBCS)

Semester-IV

I. Theory Subjects

S. No.	Type of Course	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	CR	PHY 202	Waves and Optics	4:0:0	4:0:0	4	4
2	CR	CHM 202	Coordination Chemistry, States of Matter & Chemical Kinetics	4:0:0	4:0:0	4	4
3	CR	MAT 202	Algebra	6:0:0	6:0:0	6	6
4	AEC	SSC001	Gender Equity	**3:0:0**	3:0:0	3	3
5	SEC-II		Elective subject(Skill Enhancement Course)-II	2:0:0	2:0:0	2	2
1	CR	PHY 204	Waves and Optics Practical	0:0:4	0:0:2	4	2
2	CR	CHM 204	Coordination Chemistry, States of Matter & Chemical Kinetics Practical	0:0:4	0:0:2	4	2
			Total			**27**	**23**

Total Contact Hours: 27

Total Credit Hours: 23

CR- Core Course

AEC-Ability Enhancement Compulsory Course

SEC-Skill Enhancement Course

Scheme for B.Sc. –Non Medical (CBCS)

Semester-V

I. Theory Subjects

S No.	Type of Course	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	CR	PHY	Elective Subject(Discipline)-I	4:0:0	4:0:0	4	4
2	CR	CHM	Elective Subject(Discipline)-I	4:0:0	4:0:0	4	4
3	CR	MAT	Elective Subject(Discipline))-I	6:0:0	6:0:0	6	6
4	AEC	SSC006	Human values and professional ethics	3:0:0	3:0:0	3	3
5	SEC-II		Elective subject(Skill Enhancement Course)-III	2:0:0	2:0:0	2	2

1	CR	PHY	Elective Subject(Discipline) Lab-I	0:0:4	0:0:2	4	2
2	CR	CHM	Elective Subject(Discipline) Lab-I	0:0:4	0:0:2	4	2
		Total				**27**	**23**

Total Contact Hours: 27

Total Credit Hours: 23

Scheme for B.Sc. –Non Medical (CBCS)

Semester-VI

I. Theory Subjects

S No.	Type of Course	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	DSE-IB	PHY	Elective Subject(Discipline)-II	4:0:0	4:0:0	4	4
2	DSE-IIB	CHM	Elective Subject(Discipline)-II	4:0:0	4:0:0	4	4
3	DSE-IIIB	MAT	Elective Subject(Discipline)-II	6:0:0	6:0:0	6	6
4	AEC	ENG004	Communication Skills and Personality Development	3:0:0	3:0:0	3	3
5	SEC-IV		Elective subject(Skill Enhancement Course)-IV	2:0:0	2:0:0	2	2
1	DSE-IA Lab	PHY	Elective Subject(Discipline) lab-II	0:0:4	0:0:2	4	2
2	DSE-IIB Lab	CHM	Elective Subject(Discipline) lab-II	0:0:4	0:0:2	4	2
						27	**23**

Total Contact Hours: 27

Total Credit Hours: 23

DSE-Discipline Specific Elective

SEC-Skill Enhancement Course

Summarized report of Course Scheme for B.Sc Non Medical									
Sem	**L**	**T**	**P**	**Contact hrs/wk**	**Credits hrs/wk**	**CR**	**AEC**	**SEC**	**DSE**
1	**22**	**0**	**4**	**30**	**24**	**19**	**6**		
2	**22**	**0**	**4**	**30**	**24**	**19**	**6**		
3	**19**	**0**	**4**	**27**	**23**	**19**	**3**	**2**	
4	**19**	**0**	**4**	**27**	**23**	**19**	**3**	**2**	
5	**19**	**0**	**4**	**27**	**23**		**3**	**2**	**19**
6	**19**	**0**	**4**	**27**	**23**		**3**	**2**	**19**
Total	**120**	**0**	**24**	**168**	**140**	**76**	**24**	**8**	**36**

SEMESTER I

Course Code	**MAT101**
Course Title	**Calculus**
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	+2 with Mathematics as core subject
Course Objective(CO)	It develops the techniques to simplify algebraic expressions .In addition, it encourages students to expand their knowledge through practical application in their daily life.
Course outcome	CO1 Students will be able to locate the x and y intercepts, any undefined points, and any asymptotes. CO2 Students will demonstrate the ability to compute derivatives and integrals of real valued and vector valued functions of several variables. CO3 Students will be able to identify areas in mathematics and other fields where Calculus is useful.

Unit-I

Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, Indeterminate forms.

Unit-II

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\,dx$, $\int \cos nx\,dx$, $\int \tan nx\,dx$, $\int \sec nx\,dx$, $\int (\log x)^n\,dx$, $\int \sin(nx)\sin(mx)\,dx$, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Unit-III

Rolle's theorem, Mean value theorems, Taylor's theorem with Lagrange's and Cauchy's form of remainder, Taylor's series, Maclaurin's series of sin x, cos x, e^x, log(1+x), $(1+x)^m$, Maxima and Minima.

Unit-IV

Triple product, introduction to vector functions, operations with vector-valued functions, Limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.

Text and Reference Books

S. NO	Name	Author(s)	Publisher
1	Calculus	H. Anton, I. Birens And S. Davis	John Wiley And Sons
2	Calculus	G.B. Thomas And R.L. Finney	Pearson Education

Course Code	**PHY101**
Course Title	**Mechanics**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	+2 with Physics as core subject
Course Objective(CO)	The aim of the subject is to enhance the knowledge of students in electrostatics, electrodynamics and mechanics
Course outcome	CO1 Student will demonstrate a scientific knowledge of the core physics principles in Mechanics. CO2 Have a deep understanding of Newton's laws and able to solve the Newton equations for simple configurations using various methods. CO3 Understand the foundations of chaotic motion.

Syllabus

Unit -I

Vectors: Vector algebra, Scalar and vector products Derivatives of a vector with respect to a parameter, Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients, Laws of Motion: Frames of reference, Newton's Laws of motion. Dynamics of a system of particles, Centre of Mass. Momentum and Energy: Conservation of momentum.

Unit-II

Work and Energy, Conservation of energy, Motion of rockets, Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum. Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness, Basic idea of global positioning system (GPS).

Unit-III

Oscillations: Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations. Elasticity: Hooke's law – Stress - strain diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion

Unit-IV

Torsional pendulum- Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity.Length contraction.Time dilation.Relativistic addition of velocities.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Introduction To Electrodynamics	D J Griffith	Prentice-Hall Of India
2	Physics- Vol 2	Halliday And Resnik	
3	Electricity And Magnetism	A S Mahajan And A Arangwala	Tatamcgraw-Hill

Course Code	CHM 101
Course Title	**Atomic Structures , Bonding , General Organic and Chemistry and Aliphatic Hydrocarbons**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students in Chemical bonding atomic / molecular structure, About basic concepts of organic chemistry.
Course outcome	CO1 Able to Predict electronic properties of atoms using current models and theories in chemistry. CO2 Able to Explains de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problems. CO3 Explain the significance of quantum numbers.

Unit-I

Atomic Structure**:** Review of: Bohr's theory and its limitations, dual behavior of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s , 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Rules for filling electrons in various orbitals, Electronic configurations of the atoms.Stability of half-filled and completely filled orbitals, concept of exchange energy. Energies of atomic orbitals, Anomalous electronic configurations.

Unit-II

Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of

orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approach

Unit-III

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper-conjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Unit-IV

Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction,Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution : Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidatioN Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. $KMnO_4$

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	Stereochemistry	P.S. Kalsi	New age International
6	Organic reaction mechanism	Singh and Mukharje	New age International

Course Code	ENG101
Course Title	**General English-I**
Type Course	Theory
L T P	3: 0: 0
Credits	3
Course Pre-requisite	**NA**
Course Objective (CO)	1. The students will critically read and analyze the prescribed texts. 2. The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work. 3. The students will recognize the correct usage of present/past/future tenses in contextualized speech.
Course outcome	CO1 The students will critically read and analyze the prescribed texts. CO2 The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work. CO3 The students will recognize the correct usage of present/past/future tenses in contextualized speech.

UNIT I

Tales of Life :

a. The Umbrella (Henry Rene Albert Guy de Maupassant)
b. The Story Teller (H.H. Munro Saki)
c. The Lament (Anton Pavlovich Chakhov)

UNIT II

Prose for Young Learners:

a. Universal Declaration Of Human Rights (U.N. Charter)
b. Symptoms (Jerome K. Jerome)

Exploring Tenses in English:

a. Present and Past
b. Present Perfect and Past

UNIT III

Tales of Life:

a.The Luncheon (William Somerset Maugham)
b.The Shroud (Prem Chand)

UNIT IV

Prose for Young Learners:

a. On Spendthrifts(A.G.Gardinar)
b. The Power of Women(Richard Gardon)
c. A Dialogue On Democracy (Albert Sydney Horby)

Exploring Tenses in English:

a. Future

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Singh, S	2008	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.
2	Tewari, A. K, Midha,V.K, Sharma, R.K	2011	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	2015	English Grammar in Use	Cambridge University Press

Course Code	**PBI101**
Course Title	**General Punjabi-I**
Type of Course	Theory
L T P	3: 0:0
Credits	3
Course Prerequisite	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI kvIAW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI kivqw dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQIAW nUM pMjwbI DunIN ivauNqbMdI sMbMDI igAwn hwisl ho jwvygw[5. ividAwrQI pMjwbI aup- BwSwvW nUM pCwnxXog ho jwxgy[
Course outcome	CO1 ividAwrQI AwDuink pMjwbI kvIAW dI jIvnI qoN jwxU hoxgy[CO2 ividAwrQIAW nUM AwDuink pMjwbI kivqw dI ivSYgq jwxkwrI ho jwvygI[CO3 ividAwrQIAW iv`c ryKw ic`qrW dw AiDAYn krn dw hunr auqpMn hovygw[

iekweI- a

1. **AwDuink pMjwbI kivqw:** BweI vIr isMG (rauN ru^, smW, ie`Cw bl qy fUMGIAW SwmW), DnI rwm cwiqRk(rwDw sMdyS, isdkW vwilAW dy byVy pwr ny), pRo. pUrn isMG(purwxy pMjwb nUM AwvwzW), &IrozdIn Sr&(kurbwnI, ^Yr pMjwbI dI), pRo. mohn isMG(Awau n`cIey, nvW kOqk), nMd lwl nUrpurI(cuMm cuMm r`Ko, mzdUr), AMimRqw pRIqm(bwrW mwh, sMXog ivXog), fw. hrBjn isMG(qyry hzUr myrI hwizrI dI dwsqW), iSv kumwr btwlvI(ibrhoN dI rVHk, z^m), surjIq pwqr(cONk ShIdW ‘c ausdw Awi^rI BwSx, Zzl)
2. **pMjwb dy mhwn klwkwr(lyK):** ky. AY~l. sihgl, bVy gulwm AlI KW, soBw isMG, ipRQvIrwj kpUr, BweI smuMd isMG[

iekweI- A

1. pMjwbI DunI ivauNq : aucwrn AMg, aucwrn sQwn qy ivDIAW, svr, ivAMjn[
2. BwSw vMngIAW: BwSw dw tkswlI rUp, BwSw Aqy aup- BwSw dw AMqr, pMjwbI aupBwSwvW dy pCwx icMnH[

pusqk sUcI

pwT- pusqkW

LyKk	Swl	Pusqk	PbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw; p.s.	2014	do rMg	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrgI; b.	1995	pMjwb dy mhwn klwkwr	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

LyKk	Swl	Pusqk	PbilSr
isMG; h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG; qIrQ (fw.)	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN; suKivMdr isMG (fw.) Aqy syKoN; mndIp kOr	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrz, luiDAwxw

Course code	HCP101
Course title	**History and Culture of Punjab -I**
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course objectives (CO)	1. The Student will acquire the knowledge about Punjab and its Historical Resources. 2. The Student will understand the Harppan Culture and different Vedic Periods. 3. The Students will analyze the Alexander's invasions.
Course outcome	CO1 The Student will acquire the knowledge about Punjab and its Historical Resources. CO2 The Student will understand the Harppan Culture and different Vedic Periods. CO3 The Students will analyze the Alexander's invasions.

Unit I

Ancient Punjab: Physical features, Political, Social, Economic, Geographical, Religious impact on History, Historical Sources: Literacy, Archaeological, Harappan Culture: Extent and Town Planning.

Unit II

Harppan Culture: Social, Economic and Religious life; Causes and Disappearance, Rig Vedic Age: The rise of Indo Aryans, Main features of the life in Early Vedic Age, Later Vedic Age: Political, Economic, Social, and Religious life of Later Vedic Aryans.

Unit III

Caste system: Origin and Evolution, The Epics: Historical importance of Ramayan and Mahabharat, Political condition on eve Alexander's Invasion.

Unit IV

Impact of Alexander's Invasion on Social and Culture Life., Position of Women: Harppan, Early Vedic and Later Vedic Age.

Important Historical places of Punjab: Mohenjodaro, Harappa, kotla Nihang khan, Sanghol, Banawali, Taxila, Hastinapur,Indraprastha,Srinagar, Sakala,Purusapura

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books

Course Code	**CHM 103**
Course Title	**Atomic Structures , Bonding , General Organic and Chemistry and Aliphatic Hydrocarbons**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about the separation of organic molecules and estimation of inorganic salt and metal ions.
Course outcome	CO1 Separate and identify the various ions present in the mixture . CO2 Detection of elements (N, S and halogens) in organic compounds. CO3 Detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines,amides, nitro and anilide) in simple organic compounds.

Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO4.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
4. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

Organic Synthesis

Synthesis of Acetanilide
Synthesis of Salicylic acid
Synthesis of Succinimide

Text and References Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
2	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
3	Advanced Experimental Chemistry. Vol. I	Physical, J.N. Gurtu and R. Kapoor	S. Chand & CO.
4	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
5	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS

Course Code	**PHY103**
Course Title	**Mechanics**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 physics
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students and provide them with exposure of basic measuring instruments, electricity and electronics apparatuses
Course outcome	CO1 Understand basic units of measurement, convert units, and appreciate their magnitudes. CO2 Demonstrate the ability to produce a working model through hands-on experience in fluid mechanics. CO3 Measure fluid pressure and relate it to flow velocity.

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine **g** and velocity for a freely falling body using Digital Timing Technique
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g

Text and Reference Books

S. No	Name	Author(S)	Publisher
01	*Practical Physics*	C. L. Arora	S. Chand

SEMESTER

II

Course Code	**PHY102**
Course Title	**Electricity and Magnetism**
Type of course	Core
L T P	4 0 0
Credits	4
Course prerequisite	10+2 with physics as core subject
Course Objective (CO)	The subject will add one more step to the students of first year in the fields of magnetism, electromagnetic theory, & properties of matter.
Course outcome	CO1 A fundamental understanding of electromagnetic phenomena. CO2 Learn how to analyze various problems in electromagnetism with mathematical methods. CO3 Gain experience in analyzing problems within electromagnetism.

Unit-I

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors(statement only).

Unit-II

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Unit-III

Magnetism:Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials

Unit-IV

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law,self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.Maxwell`s equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Introduction to Electrodynamics*	D J Griffith	Prentice-Hall of India
2	*Physics Vol 2*	Halliday and Resnik	
3	*Electricity and Magnetism*	A S Mahajan and A A Rangwala	Tata McGraw-Hill
4	*Berkeley Physics Course, Vol. 1, Mechanics*	E M Purcell, Ed	Tata McGraw-Hill

Course Code	MAT102
Course Title	**Differential equations**
Type of course	Core
L T P	6 0 0
Credits	6
Course prerequisite	10+2 with mathematics as core subject
Course Objective (CO)	It develop the knowledge about Differential Equations and partial equations.
Course outcome	CO1 They become able to find out the General, particular, explicit, implicit and singular solutions of a differential equation. CO2 They become able to understand the concept of Wronskian: its properties ,its applications and Linear homogeneous and non-homogeneous equations of higher order with constant coefficients. CO3 They become able to solve Partial differential equation with Lagrange's solution and Charpit's general method of solution.

Unit-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

Unit -II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-IV

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Differential Equations*	Shepley L. Ross	John Wiley and Sons
2	*Elements of Partial Differential Equations*	Sneddon	McGraw-Hill

Course Code	CHM 102
Course Title	**Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I**
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students regarding Physical concepts of chemistry like Chemical Energetic, Chemical Equilibrium. General organic chemistry of aromatic systems and functional groups.
Course outcome	CO1 Identify thermodynamic property of any system to apply it for various systems. CO2 Acquire the knowledge of phase equilibria of various systems. CO3 Demonstrate an understanding of completely miscible, partially miscible and immiscible liquids.

Unit-I

Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermo-chemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Unit-II

Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G^{o}, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

Ionic Equilibria:Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions.

Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides,Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Unit-IV

Alcohols, Phenols and Ethers (Up to 5 Carbons) Alcohols: Preparation: Preparation of 1º, 2º and 3º alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.KMnO4, acidic dichromate, conc. HNO3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben– Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO3, NH2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Organic reaction mechanism, 3rd ed. Latest edition	V. K. Ahluwalia	Narosa publishing house, New Dehli
2	Organic Chemistry	Morrison and Boyd	Prentice Hall
3	Fundamentals of Organic Chemistry	Solomons	John Wiley
4	The Elements of Physical Chemistry	P.w. Aikins	Oxford
5	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

Course Code	**ENG102**
Course Title	**General English-II**
Type Course	Theory
L T P	3 0 0
Credits	3
Course Pre-requisite	**10+2**
Course Objective (CO)	To develop understanding of the significance of English as a subject in the present context, to feel pleasure and to develop the understanding of the significance of basic competencies in language acquisition. This course will enable students to understand the foreign language as well as the use of language and to enable students to acquire language skills such as listening, speaking, reading, and writing and integrate them for communicative purposes.
Course outcome	CO1 The students will do intensive and extensive reading of the prescribed texts. CO2 The students will assimilate new words and use them in communicative context. CO3 The students will apply the knowledge of modals, voice, reported speech and auxiliary verbs in written and oral context.

Texts Prescribed:

Unit-I Tales of Life

a. The Doll's House(Katherine Mansfield)
b. Eveline (James Joyce)
c. Toba Tek Singh (Saadat Hassan Manto)
d. The Taboo (Victor Astafyev)
e. A Strand of Cotton (Suneet Chopra)

Unit-II Prose for Young Learners

a. Beauty And The Beast(R.K.Narayan)
b. With A Song On Their Lips (Hugh & Colleen Gantzer)
c. My Financial Careers (Stephen Leacock)
d. The School For Sympathy (E.V. Lucas)
e. AIDS (U.N.Report)

UNIT-III Exploring Grammar

a. Modals
b. Passive

UNIT-IV

c. Reported Speech
d. Questions and Auxiliary verbs

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Singh, S	2008	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.

2	Tewari, A. K, Midha,V.K, Sharma, R.K	2011	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	2015	English Grammar in Use	Cambridge University Press

Course Code	**PBI102**
Course Title	**General Punjabi-II**
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI khwxIkwrW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI khwxI dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQI muhwvry, AKwxW dI Fu`kvIN vrqoN krnW is`K jwxgy
Course outcome	CO1 ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[CO2 ividAwrQIAW nUM AwDuink pMjwbI khwxI dI ivSYgq jwxkwrI ho jwvygI[CO3 ividAwrQI AwDuink pMjwbI khwxIkwrW dI jIvnI qoN jwxU hoxgy[

iekweI- a

1. **pMjwbI in`kI khwxI**: BUAw (nwnk isMG), bwZI dI DI (gurmuK isMG muswi&r), pymI dy inAwxy(sMq isMG syKoN), bwgW dw rwKw(sujwn isMG), qYN kI drd nw AwieAw(krqwr isMG du`gl), DrqI hyTlw bOlD(kulvMq isMG ivrk), dUjI vwr jyb k`tI geI(nvqyj isMG), lCmI(pRym pRkwS), bu`q iSkn(AjIq kOr), b`s kMfktr(dlIp kOr itvwxw)[
2. **pMjwb dy mhwn klwkwr (lyK):** sqIS gujrwl, gurcrn isMG, Twkur isMG,blrwj swhnI, suirMdr kOr[

iekweI- A

1. Sbd bxqr Aqy Sbd rcnw: pirBwSw Aqy mu`Fly sMklp
2. (a) pYrHw rcnw, muhwvry Aqy AKwx[
   (A) pYrHw pVH ky pRSnW dy au~qr dyxw[

pusqk sUcI

pwT- pusqkW

LyKk	Swl	Pusqk	PbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw, p.s.	2014	do rMg	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrgI, b.	1995	pMjwb dy mhwn klwkwr	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

LyKk	Swl	Psqk	PbilSr
isMG, h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG, q.	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN, s.s. Aqy syKoN, m.k.	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrz, luiDAwxw

Course ode	**HCP 102**
Course title	**History And Culture Of Punjab –II**
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course objectives (CO)	1. The Student will acquire the knowledge Of Mauryan Empire. 2. The Student will understand the impact of Buddhism & Jainism on Punjab. 3. To aware the learners Depiction of Punjab in the accounts of Chinese travelers.
Course outcome	CO1 The Student will acquire the knowledge about Punjab and its Historical Resources. CO2 The Student will understand the Harppan Culture and different Vedic Periods. CO3 The Students will analyze the Alexander's invasions.

Unit-I

The Mauryan Empire: Social, Economic and Religious life, Buddhism and Jainism: Impact on Punjab with special reference to 4th Buddhist Council., The Kushanas: Impact of Kanishka's rule on Punjab.

Unit-II

Gandhara School of Art: Salient features, The Guptas: Cultural and Scientific Developments.

Position of Women: Under the Mauryas, the Guptas and the Vardhanas.

Unit-III

Depiction of Punjab in the accounts of Chinese travelers. Fahien and Hwen Tsang. Main developments in literature, Education: Significant Developments: Taxila.

UNIT IV

Society and Culture on the eve of the Turkish invasion of Punjab,Punjab in the Kitab-ul-Hind of Alberuni,Important Historical places: Lahore, Multan Bathinda, Uchh, Jalandhar, Thanesar, Kangra, Taxila, Kundalvana, Pehowa, Thatta.

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books
30	L.M.Joshi	History and Culture of the Punjab, Vol. I	Punjabi University, Patiala

Course Code	CHM 104
Course Title	**Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry-I**
Type of course	PRACTICAL
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to provide practical knowledge about the preparation of organic compounds, Thermo-chemistry and Ionic equilibrium.
Course outcome	CO1 Accurately note down the melting and boiling point of organic compounds. CO2 Find out the acidity, Basicity and PKa Value on pH meter. CO3 Different separation techniques.

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.

Ionic equilibria

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) Preparation of buffer solutions:

(i) Sodium acetate-acetic acid

(ii) Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.

2 Criteria of Purity: Determination of melting and boiling points.

3 Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

(d) Acetylation of amines/phenols

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company

Course Code	PHY104
Course Title	**Electricity and Magnetism**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 with physics as core subject
Course Objective (CO)	The course is to impart practical knowledge to the students and provide them with practical exposure of electricity and magnetism
Course outcome	CO1 "To understand the importance of experiment as the basis of the scientific method. CO2 " Better understand physics concepts covered in lecture by seeing their application in expt. CO3 Analyzing data and drawing conclusions from "real world" experiments.

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and
   (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer Theorem

S. No	Name	Author(S)	Publisher
01	*Practical Physics*	C. L. Arora	S. Chand

SEMESTER
III

Course Code	**PHY201**
Course Title	**Thermal physics and statistical mechanics**
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 1st with physics as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in thermal, statistical and atomic physics.
Course outcome	CO1 "Be able to solve statistical mechanics problems for simple non-interacting systems. " CO2 Have a basic understanding of the phase transitions. CO3 Be able to use linear response theory and kinetic equation approach.

Unit-I

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermo dynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Unit-II

Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations.

Unit-III

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Unit-IV

Statistical Mechanics: Phase space, Microstate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Statistical Physics and Thermodynamis*	V S Bhatia	
2	*A Treatise on Heat*	Saha and Srivastava	Indian Press, Ahmedabad
3	*Thermal Physics*	C. Kittel & H. Kroemer	CBS Pub.
4	*Thermal Physics*	S C Garg, R M Bansal & C K Ghosh	TMH

Course Code	**MAT201**
Course Title	**Real analysis**
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc. 1st with mathematics as core subject
Course Objective (CO)	To have the knowledge of basic properties of field of real numbers and convergence
Course outcome	CO1 They become able to find Bounded and unbounded sets, Infimum and supremum of a set. CO2 They can understand Bolzano- Weierstrass theorem for sets, topology of real line and Rn. CO3 They become able to understand the Theorems on limits of sequences, Subsequences, Monotone sequences, Monotone convergence Theorem.

Unit-I

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

Unit-II

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

Unit-IV

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Introduction to Real Analysis*	R.G. Bartle and D. R Sherbert	John Wiley and Sons
2	*Elementary Analysis*	K.A. Ross	Springer Verlag,
3	*Intermediate Real Analysis*	E. Fischer	Springer Verlag

Course Code	CHM 201
Course Title	**Solutions , Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II**
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc. 1st with chemistry as core subject
Course Objective	The aim of this course is to impart knowledge to the students about basic of solution chemistry, phase equilibia, Electrochemistry and organic chemistry and natural polymers.
Course outcome	CO1 Understand structure and bonding in carboxylic acids and carboxylic acid derivatives. CO2 Describe preparations, physical properties, and reactions of carboxylic acids and carboxylic acid derivatives. CO3 Carbohydrate and chiral approach, chiral drugs and medicinal chemistry.

Unit-I

Solutions: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Phase Equilibrium: Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H2O and Na-K only).

Unit-II

Conductance: Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Carboxylic acids and their derivatives Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their

interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons)Preparation : from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Unit-IV

Amino Acids, Peptides and Proteins: Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis Reactions of Amino acids: ester of –COOH group, acetylation of –NH2 group, complexation with Cu^{2+} ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).
Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in mono-saccharides. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Natural Products: Chemistry and Biological Significance,	Mann, J.; Davidson, R.S.; Hobbs, J.B.; Banthrope, D.V.; Harborne, J.B.	Longman, Esse
2	Organic reaction mechanism, 3rd ed. Latest edition	V. K. Ahluwalia	Narosa publishing house, New Dehli
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
40	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd
7	Physical Electrochemistry-Fundamentals, Techniques and Applications	Eliezer Gileadi,	Wiley-VCH

Course Code	EVS001
Course Title	**Environmental Science**
Type of course	Theory
L T P	3 0 0
Credits	3
Course prerequisite	NA
Course Objective (CO)	To make students aware about environment and need of maintaining it with best possible knowledge.
Course outcome	CO1 To gain understanding of enviornment and ecosystem. CO2 To study environmental pollutions and natural resources. CO3 To study social issues related to envionment.

UNIT-I

Introduction to Environment and Ecosystem: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness, Concept of Ecosystem, Structure, interrelationship, producers, Consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

UNIT-II

Environmental Pollution & Natural Resources: 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, Natural Resources and associated problems, use and over exploitation, case studies of forest mresources and water resources.

UNIT-III

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

UNIT-IV

Human Population and the Environment & Field Work: 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

Visit to a local area to document environemntal assetsriver/forest/grassland/hill/mountain;Visit to a local polluted site-Urban/Rural/Industrial/Agricultural;Study of common plants, insects, birds;Study of simple ecosystems-pond, river, hill slopes, etc.

Text and reference books:

S. No	Title	Author(S)	Publisher
1	A Textbook for Environmental Studies	Erach Bharucha	
2	Environmental Biology,	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
3	Environmental Science,	Miller T.G. Jr.	Wadsworth

Course Code	CHM 203
Course Title	**Solutions , Phase equilibrium, Conductance, Electrochemistry and Functional Organic Chemistry-II**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc. 1st with chemistry as core subject
Course Objective	To provide practical knowledge about conductometry , potentiometry and qualitative organic analysis.
Course outcome	CO1 Calculate molar and normal solution of various concentrations. CO2 Determine specific rotations and percentage of to optically active substances by polorimetrically. CO3 Study the energy of activation and second order reaction.

Distribution: Study of the equilibrium of one of the following reactions by the distribution method:

$I_2(aq) + I^-(aq) \; I_3^-(aq) \quad Cu^{2+}(aq) + xNH_2(aq) \; [Cu(NH_3)_x]^{2+}$

Phase equilibria

Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

Determination of cell constant
Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

Perform the following conductometric titrations:

i. Strong acid vs. strong base
ii. Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base
ii. Weak acid vs. strong base
iii. Potassium dichromate vs. Mohr's salt

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Determination of the concentration of glycine solution by formylation method.

1. Titration curve of glycine
2. Action of salivary amylase on starch
3. Effect of temperature on the action of salivary amylase on starch.
4. Differentiation between a reducing and a non reducing sugar.
5. Organic and inorganic synthesis

Text and Reference Books

S. No	Name	Author(S)	Publisher
01	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
02	Laboratory Experiments on Organic Chemistry	R. Edemas, J.R. Johnson and C.F. Wilcox	The Macmillan Limited, London,
	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
03	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company Limited.

Course Code	**PHY203**
Course Title	**Thermal physics and statistical mechanics**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc. 1st with physics as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students and provide them with exposure of thermodynamics.
Course outcome	CO1 Different ensemble theories to explain the behaviour of the systems. CO2 Connection between statistics and thermodynamics. CO3 Statistical behaviour of ideal Bose and Fermi systems.

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1	*Advanced Practical Physics for students*	B.L. Flint & H.T. Worsnop	Asia Publishing House.
2	*Advanced level Physics Practicals*	Michael Nelson and Jon M. Ogborn	Heinemann Educational Publishers
3	*A Text Book of Practical Physics*	Indu Prakash and Ramakrishna	Kitab Mahal, New Delhi

SEMESTER

IV

Course Code	**PHY202**
Course Title	**Waves and optics**
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc 1st with Physics as core subject
Course Objective (CO)	The main objective of the course is to enhance the knowledge of students in wave and optics, the two key subjects of physics.
Course outcome	CO1 The wave optics part of the course will give the student a thorough fundamental knowledge within interferometry. CO2 The student will become able to analyze and understand interference between plane waves and spherical waves. CO3 The student will get a thorough knowledge of the polarization of light and its changes upon reflection.

Unit-I

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.

Unit-II

Fluids: Surface Tension: Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaegar's method. Viscosity: Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of a liquid with temperature lubrication. Detection of leakage Sound: Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.

Unit-III

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Interference: Division of amplitude and division of wave front. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes).

Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

Unit-IV

Diffraction: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction patternof a straight edge, a slit and a wire using half-period zone analysis. Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*University Physics*	FW Sears, MW Zemansky and HD Young 13/e	Addison-Wesley
2	*Fundamentals of Optics*	H.R. Gulati and D.R. Khanna	R. Chand Publication
3	*Fundamentals of Optics*	F A Jenkins and H E White	McGraw-Hill
4	*Principles of Optics*	B.K. Mathur	Gopal Printing

Course Code	**MAT202**
Course Title	**Algebra**
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc 1st with Mathematics as one core subject
Course Objective (CO)	It develops the techniques to simplify algebraic expressions using commutative, associative and distributive properties.
Course outcome	CO1 Students will have a working knowledge of important mathematical concepts in abstract algebrasuch as definition of a group, order of a finite group and order of an element. CO2 Students will be knowledgeable of different types of subgroups such asnormal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups. CO3 Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics.

Unit-I

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Unit-II

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Unit-III

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

Unit-IV

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*A First Course in Abstract Algebr*	John B. Fraleigh	Pearson
2	*Abstract Algebra*	M. Artin	Pearson
3	*Contemporary Abstract Algebra*	Joseph A Gallian	Narosa

Course Code	CHM 202
Course Title	**Coordination Chemistry, States of Matter and Chemical Kinetics**
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 1st with chemistry as core subject
Course Objective	The aim of this course is to impart knowledge to the students about basic of transition elements, their bonding, states of matter and chemical kinetics.

Unit-I

Transition Elements (3d series):General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).
Coordination Chemistry: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6.Drawbacks of VBT. IUPAC system of nomenclature.

Unit-II

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for *Oh* and *Td* complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Unit-III

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required).
Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).
Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).
Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals.

Unit-IV

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Introduction to Ligand Field	B.N. Figgis	Wiley Eastern.
4	Introduction to Liquid State	P.A. Eglestaff	Academic Press.
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry, A Molecular Approach	MacQuarrie and Simon	University Science Books,
7	Principles of Inorganic Chemistry	Puri, Sharma and Kalia	Vishal publishers

Course Code	**SSC001**
Course Title	**Gender Equity**
Type of course	ID
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course Objectives (CO)	1. The students will be able to acquire knowledge and understanding of theory and concepts related to gender and gender relations 2. The students will be able to critically reflect how gender is a development issue.
Course Outcome	CO1 Students will have a working knowledge of important mathematical concepts in abstract algebrasuch as definition of a group, order of a finite group and order of an element. CO2 Students will be knowledgeable of different types of subgroups such asnormal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups. CO3 Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics.

UNIT I

Concept of sex and gender

Gender attributes and questions of identity.

UNIT II

Empowerment- concept and meaning.

Definition of feminism, feminist and women movements in U.S.A, U.K., France and India

UNIT III

Women development and development organizations.

Impact of development on gender.

UNIT IV

Policies and current debates on women rights.

Role of UN in establishing gender equality.

Violence against women and need for reforms.

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Jayachandran, Seema	2014	The Roots of Gender Inequality in Developing Countries	NBER Working Paper No.20380. Issued in August 2014
2	Duflo, Esther	2012	Women's Empowerment and Economic Development	*Journal of Economic Literature, 50(4): 1051-79.*

Course Code	CHM 204
Course Title	**Coordination Chemistry, States of Matter and Chemical Kinetics**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	BSc. 1st with chemistry as core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about semi micro qualitative analysis and physical properties of solutions.
Course Outcome	CO1 Compare the viscosity and surface tension of different liquids and solutions. CO2 To understand the concept of hardness of water and its analysis by EDTA method. CO3 Understand and master the technique of gravimetric analysis.

Semi-micro qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-},BO_3^{3-}, $C_2O_4^{2-}$, F^-*(Spot tests should be carried out wherever feasible)*

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.

(I) Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded).

a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Integrated rate method:
   a. Acid hydrolysis of methyl acetate with hydrochloric acid.
   b. Saponification of ethyl acetate.

c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS
3	Advanced Practical Physical Chemistry	J.B. Yadav	KRISHNA Prakashan Media (P) Ltd,

Course Code	PHY204
Course Title	**Waves and optics**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc 1st with Physics as one core subject
Course Objective (CO)	This course is designed for improving practical knowledge among the students and provides them with exposure on wave and optics related experiments.
Course outcome	CO1 Apply knowledge of thermodynamics, sound waves, and light waves to explain natural physical processes. CO2 Use an understanding of algebraic mathematics along with physical principles to effectively solve problems. CO3 Design experiments and acquire data in order to explore physical principles.

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Advanced Practical*	B.L. Flint & H.T.	Asia

	Physics for students	Worsnop	Publishing House.
2	*Advanced level Physics Practicals*	Michael Nelson and Jon M. Ogborn	Heinemann Educational Publishers
3	*A Text Book of Practical Physics*	Indu Prakash and Ramakrishna	Kitab Mahal, New Delhi

SKILL ENHANCEMENT COURSES

Course Code	**PHY205**
Course Title	**Physics workshop skill**
Type of course	Skill enhancement
L T P	2:0:0
Credits	2
Course prerequisite	B.Sc 1st with Physics as one core subject
Course Objective (CO)	The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.
Course outcome	CO1 The student will able to know about the skill used about particular tools. CO2 Understanding of basic knowledge of measuring devices. CO3 Experience with various mechanical and electrical tools.

UNIT I

Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT II

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines.

UNIT III

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

UNIT IV

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	A text book in electrical technology	B l theraja	S. Chand and company
2	Performance and design of ac machines	M.g. say	Elbs edn
3	Mechanical workshop practice	K.c. john, 2010	Phi learning pvt. Ltd.
4.	Workshop processes, practices and materials	Bruce j black 2005,	3rd edn., editor newnes [isbn: 0750660732]

Course Code	**MAT207**
Course Title	**Logic and sets**
Type of course	Skill Enhancement
L T P	2:0:0
Credits	2
Course prerequisite	B.Sc 1st with Mathematics as one core subject
Course Objective (CO)	The aim of the subjects that students have basic knowledge of sets, relation and basic operators.
Course outcome	CO1 They become able to understand the concept of Truth table ,conjunction and disjunction, Biconditional and propostions. CO2 They become able to learn sets, subsets law of theory and venn diagram. CO3 They can understand Propositinal equivalewnce.

UNIT I:

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

UNIT II:

Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

UNIT III:

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

UNIT IV:

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Discrete Mathematics and Combinatorial Mathematics*	R.P. Grimaldi	Pearson Education
2	*Naive Set Theory*	P.R. Halmos	Springer
3	*Theory of Sets*	E. Kamke	Dover Publishers,

Course Code	**CHM 209**

Course Title	**Basic Analytical Chemistry**
Type of course	Skill Enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	B.sc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in analytical chemistry.
Course outcome	CO1 Expresses the role of analytical chemistry in science. CO2 Compare qualitative and quantitative analyses. CO3 Estimates kinds of errors in chemical analysis.

UNIT I:

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators a. Determination of pH of soil samples. b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. a. Determination of pH, acidity and alkalinity of a water sample. b. Determination of dissolved oxygen (DO) of a water sample.

UNIT II:

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+})

b. To compare paint samples by TLC method.

UNIT III:

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics**:** Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.

b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Unit IV:

Suggested Applications (Any one):

a. To study the use of phenolphthalein in trase cases.

b. To analyze arson accelerants.
c. To carry out analysis of gasoline.
Suggested Instrumental demonstrations**:**
a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft drink

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Vogel's Qualitative Inorganic Analysis (7^{th} Edition). ISBN-13:978-0582219666,	G Svehla	Prentice Hall
4	Vogel's Quantitative Chemical Analysis (6^{th} Edition), ISBN-13:978-0582226289,	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
5	Instrumental Analysis	G.D. Christian and J.E.G. Reily	Allegn Becon, Latest edition
6	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

Course Code	**PHY206**
Course Title	Electrical circuits and network skills
Type of course	Skill enhancement
L T P	2:0:0
Credits	2
Course prerequisite	B.sc. Ist, IInd year with Physics as core subject
Course Objective (CO)	The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode
Course outcome	CO1 Acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases. CO2 Demonstrate an understanding of basic principles of colligative properties. CO3 Understand the basic concepts of colloidal state of matter and applications of colloids.

UNIT I

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity Familiarization with multimeter, voltmeter and ammeter. Understanding electrical circuits: Main electric circuit and their combination Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex powercomponents of AC source. Power factor. Saving energy and money.

UNIT II

Electrical Drawing and Symbols: Drawing symbols. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Generators and Transformers: DC Power sources. AC/DC generators. Inductance,capacitance, and impedance. Operation of transformers.

UNIT III

Electric Motors: Single-phase, three-phase & DC motors. Basic design. DC or AC sources to control heaters & motors. Solid state devices: Inductors, capacitors, diode, resistor Components .In series or in shunt. Response of inductors and capacitors with DC or AC source.

UNIT-IV

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder.

Text and Reference Books

S. NO	NAME	AUTHOR(S)	PUBLISHER
1.	*A text book in electrical technology*	B l theraja	S chand & co.
2.	*A text book of electrical technology*	A k theraja	S chand & co.

Course Code	**MAT208**
Course Title	Number theory
Type of course	Skill enhancement
L T P	2:0:0
Credits	2
Course prerequisite	B.sc. Ist, IInd year with mathematics as core subject
Course Objective (CO)	.It develops The Knowledge about number theory and combinations of numbers.
Course outcome	CO1 Students will gain the knowledge of divisibility and related algorithms. CO2 Students will be able to solve the Diophantine equations. CO3 Students will understand and gain the knowledge of Mobius inversion formula, Euler's phi functions, the greatest integer functions.

Syllabus

UNIT I:

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem,

UNIT II:

Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

UNIT III:

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product,

UNIT IV:

Mobius inversion formula, the greatest integer function, Euler's phi-function

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1	*Elementary Number Theory*	David M. Burton	Tata McGraw-Hill
2	*Beginning Number Theory*	Neville Robinns	Narosa Publishing

Course Code	CHM 210
Course Title	Green methods in chemistry
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in Green methods in chemistry.
Course outcome	CO1 Integrate, synthesize, and apply knowledge of the relationship between science and technology and societal issues in both focused and broad interdisciplinary contexts. CO2 Analyze a process and identify parameters that make environmentally friendly/sustainable/green. CO3 Demonstrate the ability to effectively communicate to others the concepts learned in the course.

UNIT – I

Introduction: Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents, Green Chemistry and catalysis and alternative sources of energy, Green energy and sustainability.

UNIT – II

The Real world Cases in Green Chemistry: Surfactants for carbon dioxide – Replacing smog producing and ozone depleting solvents with CO for precision cleaning and dry cleaning of garments.

Designing of environmentally safe marine antifoulant.

UNIT –III

Right fit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

UNIT - IV

Preparation and characterization of biodiesel from vegetable oil. Extraction of D-limonene from orange peel using liquid CO prepared from dry ice. Mechano- chemical solvent free synthesis of azomethine. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. & Warner, J.K.	Oxford University Press
2	Introduction to Green Chemistry, 2001	Matlack, A.S.	Marcel Dekker

3	Real-World cases in Green Chemistry, 2000	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington
4	Introduction to Green Chemistry, 2002	Ryan, M.A. & Tinnesand, M.	American Chemical Society, Washington

Course Code	**MAT211**
Course Title	**Statistical Techniques with Excel**
Type of course	Skill Enhancement
L T P	2:0:0
Credits	2
Course prerequisite	+ 2 with mathematics
Course Objective (CO)	Practical/lab work to be performed on a computer through excel
Course outcome	CO1 knowledge about statistical tools used in excel CO2 knowledge about research using correlation and regression CO3 Understanding about t, f and z test in excel

Central Tendency: Mean, median and mode, Dispersion: range, standard deviation Fitting of Binomial, Poisson, Negative Binomial, Normal Distribution.

Applications of Chi-square, t and F distribution

Calculation of correlation coefficient, Rank Correlation etc

Fitting of polynomials and regression curves

Methods of estimation (MLE and method of moments)

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Robert V Hogg	Introduction to mathematical statistics	Pearson Education
2	Irwin Miller	Mathematical Statistics with application	Pearson Education

Course Code	**PHY309**
Course Title	**Renewable and Energy Harvesting**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Physics as core subject
Course Objective (CO)	The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible
Course outcome	CO1 They have a deep understanding of renewable and energy harvesting. CO2 Knowlege about an extensive range of resources to resolve the energy-related problems. CO3 Knowledge for Solar energy harvesting with application of nanotechnology.
Course outcome	CO1 They have a deep understanding of renewable and energy harvesting. CO2 Knowlege about an extensive range of resources to resolve the energy-related problems. CO3 Knowledge for Solar energy harvesting with application of nanotechnology.

UNIT I

Fossil fuels and Alternate Sources of energ**y:** Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. Tidal Energy, Wave energy systems, Ocean. Solar energy, biomass, biochemical conversion, biogas generation, tidal energy, Hydroelectricity

UNIT II

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Ocean Energy: Ocean Energy Potential against Wind and Solar, Ocean Thermal Energy.

UNIT III

Geothermal Energy: Thermal Energy Conversion ,Geothermal Resources, Geothermal Technologies. Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Piezoelectric Energy harvesting: Introduction: piezoelectrics and Piezoelectricity.

UNIT IV

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent application carbon captured technologies, cell, batteries, power consumption Environmental issues and Renewable sources of energy, sustainability

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Non-conventional energy sources	G.D Rai	Khanna Publishers, New Delhi
2	Solar energy	M P Agarwal	S Chand and Co. Ltd.
3	Solar energy	Suhas P Sukhative	Tata McGraw - Hill Publishing Company Ltd
4	"Renewable Energy, Power for a sustainable future"	Godfrey Boyle,	Oxford University Press, in association with The Open University.
5	Photovoltaics	J.Balfour, M.Shaw and S. Jarosek	Lawrence J Goodrich (USA).

Course Code	**MAT305**
Course Title	**Vector Calculus**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Mathematics as core subject
Course Objective (CO)	It Helps to define vector space , Null Space , nullity and linear transformation
Course outcome	CO1 Students will be familiar with differentiation and partial differentiation of vector functions. CO2 Students will be able to find the derivatives of sum, dot product and cross product of two vector functions. CO3 Students will be able to find the gradient, divergence and curl of functions.

UNIT I:

Differentiation

UNIT II:

partial differentiation of a vector function.

UNIT III:

Derivative of sum, dot product and cross product of two vectors.

UNIT IV:

Gradient, divergence and curl.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Calculus*	H. Anton	John Wiley and Sons
2	*Vector Calculus*	P.C. Matthew's	London Limited

Course Code	CHM 313
Course Title	**Fuel chemistry**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in petroleum and fuel chemistry.
Course outcome	CO1 Ability to characterize the fuels. CO2 Understanding of kinetics of combustion. CO3 Understand and analyze the combustion mechanisms of various fuels.

UNIT I:

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

UNIT II:

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking)

UNIT III:

Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

UNIT IV:

Lubricants: Classification of lubricants, lubricating oils (conducting and nonconducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricant (viscosity index, cloud point, pore point) and determination.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
2	Engineering Chemistry	Jain, P.C. & Jain, M.	Dhanpat Rai & Sons, Delhi

3	Instrumental methods of chemical analysis	B.K.sharma	Krishna prakashan media LTD
4	Industrial Chemistry	Sharma, B.K. & Gaur, H.	Goel Publishing House, Meerut
5	Industrial Chemistry Vol-I,	Stocchi, E.	Ellis Horwood Ltd. UK (1990).

Course Code	**PHY314**

Course Title	Radiology and Safety
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Physics as core subject
Course Objective (CO)	The aim of this course is to enable the students to enhance the knowledge of radiation physics through hands-on mode.
Course outcome	CO1 Familiar with specific opportunities for improving care to patients. CO2 Knowledge about Development of patient safety information and learning systems. CO3 "Familiar Radiology and Nuclear Medicine Procedures. X-ray safety"

Unit-I

Basics of Atomic and Nuclear Physics: Basic concept of atomic strpucture; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

Unit-II

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons - Photoelectric effect, Compton Scattering, Pair Production, Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation.

Unit-IV

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management.

Unit-V

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, ,Mining and oil. Industrial Uses: Tracing, Gauging, Material Modification, Sterization, Food preservation.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Fundamental Physics of	W.J. Meredith and J.B.	John Wright and Sons, UK,

	Radiology	Massey	1989.
2	“Fundamentals of Radiation Dosimetry”	J.R. Greening	Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981..
3	Practical Applications of Radioactivity and Nuclear Radiations,	G.C. Lowental and P.L. Airey	Cambridge University Press, U.K., 2001
4	“Medical Radiation Physics”	W.R. Hendee	Year Book – Medical Publishers Inc. London, 1981
5	An Introduction to Radiation Protection,	A. Martin and S.A. Harbisor	John Willey & Sons, Inc. New York, 1981.

Course Code	**MAT310**
Course Title	**Transportation and game theory**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Mathematics as core subject
Course Objective (CO)	.The aim of Subject To develops The knowledge about Mathematical Formulation and Games With Mixed Strategies
Course outcome	CO1 Students will be able to solve transportation problems arising in real life applications. CO2 Students will be able to solve simple games using various techniques. CO3 Students will be able to identify strategic situations and represent them as games.

UNIT I:

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem,

UNIT II:

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

UNIT III:

Game theory: formulation of two person zero sum games, solving two person zero sum games,

UNIT IV:

Games with mixed strategies, graphical solution procedure

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Linear Programming and netgwork flows*	Mokhtar S. Bazaraa	John Wiley and Sons
2	*Introduction to Operations Researc*	F. S. Hillier and G. J. Lieberman	Tata McGraw Hill
3	*Operations Research, An Introduction*	Hamdy A. Taha	Prentice-Hall

Course Code	**CHM 318**
Course Title	**Pharmaceutical Chemistry**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in Pharmaceutical chemistry.
Course outcome	CO1 To be able to use modern instrumentation techniques which is used in industries. CO2 Work to a professional level of skills in a chemical synthesis laboratory. CO3 Work to a manufacturing department as a chemist in pharmaceutical company.

UNIT I

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

UNIT-II

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

UNIT –III

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

UNIT –IV

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

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Introduction to Medicinal Chemistry	G.L. Patrick	Oxford University Press, UK.
2	Medicinal and Pharmaceutical Chemistry,	Hakishan, V.K. Kapoor	Vallabh Prakashan, Pitampura, New Delhi
3	Principles of Medicinal Chemistry	William O. Foye, Thomas L., Lemke , David A. William	B.I. Waverly Pvt. Ltd. New Delhi
4	Medicinal Chemistry-the role of organic chemistry in drug, 1993	C. R. Ganellin, and S. M. Roberts	Academic Press
5	Medicinal Chemistry-principles and practice,1994	F. D. King	Royal Society of Chemistry

Discipline Elective Courses
(SEM V, VI)
(Any two of each subjects in both semesters)

SEMESTER-V

Course Code	SSC006
Course Title	**Human values& Professional Ethics**
Type of Course	ID
L T P	3:0:0
Credits	3
Course Prerequisites	None
Course Objectives (CO)	To help the students to discriminate between valuable and superficial in the life. To help students develop sensitivity and awareness; leading to commitment and courage to act on their own belief. This Course will encourage the students to discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life. This course is an effort to fulfill our responsibility to provide our students significant input about understanding
Course Outcome	1. Students will behave ethically and promote human values in society. 2. Students will behave professionally.

UNIT-I:Course Introduction-Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education, Understanding Happiness and Prosperity correctly.
Understanding Harmony in the Human Being : Understanding the harmony with self and the Body: Sanyam and Swasthya.

UNIT II:Harmony in Human Relationship:

Understanding harmony in the Family- the basic unit of human interaction, visualizing a universal harmonious order in society **Understanding Harmony in the Nature and** Existence: Understanding the harmony in the Nature, Holistic perception of harmony at all levels of existence

UNIT III: Understanding of Harmony on Professional Ethics:

Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
.

UNIT IV:Strategy for transition from the present state to Universal Human Order:

At the level of individual, at the level of society. **Case studies**: typical holistic technologies, management models and production systems

Recommended Books

S. No.	Author(S)	Year	Publisher
1	A Foundation Course in Value Education	R R Gaur, R Sangal	Excel Books Publishers
2	Energy & Equity	Ivan Illich	.The Trinity Press, Worcester, and HarperCollins, USA
3	Human Values and Professional Ethics	RishabhAnand	Satya Prakashan, New Delhi
4	Jeevan VidyaekParichay.	A Nagraj	Divya Path Sansthan

Course Code	PHY301
Course Title	**Digital and analog circuits and instrumentation**
Type of course	Discipline elective(theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is not just to impart theoretical knowledge to the students about digital electronics and analog circuits and instrumentations
Course outcome	CO1 Able to analyze logic processes and implement logical. CO2 Able to understand concepts of sequential circuits . CO3 Develop a digital logic and apply it to solve real life problems.

UNIT-I

Digital Circuits**:** Difference between Analog and Digital Circuits. Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates, XOR and XNOR Gates, De Morgan's Theorems, Boolean Laws. Simplification of Logic Circuit using Boolean Algebra, Conversion of a Truth Table into an Equivalent Logic Circuit by Karnaugh Map, Binary Addition, Binary Subtraction using 2's Complement Method.Half Adders and Full Adders and Subtractors, 4-bit binary Adder- Subtractor.

UNIT-II

Semiconductor Devices and Amplifiers **:** Semiconductor Diodes: p and n type semiconductors, Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics, Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.Bipolar Junction transistors: n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations. Active, Cutoff and Saturation Regions. Current gains α and β, Relations between α and β. Load Line a nalysis of Transistors. DC Load line and Q-point.

UNIT-III

Operational Amplifiers (Black Box approach) : Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator,(6) Zero Crossing Detector.

UNIT-IV

Instrumentations: Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode

Text and Reference Books

S. No	Name	Author(s)	Publisher
1	Integrated electronics	J. Millman and c.c.	Tata mc-graw hill.

		halkias, 1991	
2	Electronic devices and circuits	S. Salivahanan and n. Suresh kumar, 2012,	Tata mc-graw hill.
3	Microelectronic circuits,	M.h. rashid, 2ndedn.,2011	Cengage learning.
4	Modern electronic instrumentation & measurement tech	Helfrick&cooper,1990	Phi learning
5	Digital principles & applications,,	A.p. malvino, d.p. leach & saha, 7th ed.,2011,	Tata mcgraw hill.

Course Code	**PHY303**
Course Title	**Digital and analog circuits and instrumentation**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is not just to impart practical knowledge to the students about digital electronics and analog circuits and instrumentations.
Course outcome	CO1 Become to analyze, design and implement combinational logic circuits. CO2 Enable to Classify different semiconductor memories. CO3 Enable to analyze, design and implement sequential logic circuits.

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder.
5. Adder-Subtractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
13. To study a precision Differential Amplifier of given I/O specification using Op-amp.
14. To investigate the use of an op-amp as a Differentiator
15. To design a Wien Bridge Oscillator using an op-amp.

Text and Reference Books

S. NO	NAME	AUTHOR(S)	PUBLISHER
1	Basic electronics: a text lab manual,	P.b. Zbar, a.p. Malvino, m.a. Miller, 1994,	Tata mc-graw hill.
2	Electronics: fundamentals and applications,	J.d. Ryder, 2004,	Prentice hall..
3	Microelectronic circuits,	M.h. Rashid, 2ndedn.,2011	Cengage learning.
4	Op-amps and linear integrated circuit,	R. A. Gayakwad, 4th edition, 2000,	Prentice hall.

5	Electronic principle	Albert malvino, 2008	Tata mcgraw hill.

Course Code	**PHY305**
Course Title	**Elements of modern physics**
Type of course	Discipline elective(theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is just to impart theoretical knowledge to the students with the one more important subject of physics, named as quantum mechanics. This is addition in the knowledge of mechanics at micro-state level.
Course outcome	CO1 They have Ability to solving physical problems. CO2 To have Ability of searching solutions of physical problems in scientific and technical literature. CO3 To become have understanding of physical processes and technology.

UNIT I

Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms, Heisenberg uncertainty principle, Energy time uncertainity principle.

UNIT II

Two slit interference experiment with photons, atoms and particles; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wave function, probabilities and normalization; Probability and probability current densities in one dimension.

UNIT III

Quantum dot as an example; Quantum mechanical scattering and tunneling in one dimension - across a step potential and across a rectangular potential barrier. Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, semi-empirical mass formula and binding energy. Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.

UNIT IV

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting withUranium235; Fusion and thermonuclear reactions

Text and reference books

S. No	Name	Author(s)	Publisher
1	Concepts of modern physics,	Arthur beiser, 2009	Tata mc-graw hill.
2	Six ideas that shaped physics: particle behave like waves	Thomas a. Moore, 2003,,	Tata mc-graw hill.
3	Quantum physics	Berkeley physics course vol.4. E.h. wichman, 2008	Tata mc-graw hill.

Course Code	**PHY307**
Course Title	**Elements of modern physics**
Type of course	Discipline elective(practical)
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is just to impart practical knowledge to the students with the one more important subject of physics, named as quantum mechanics. This is addition in the knowledge of mechanics at micro-state level.
Course outcome	CO1 EnableTo kindle the interest for research in students. CO2 Become to understand the importance of experiment as the basis of the scientific method. CO3 To become excel in Experimental and Theoretical in Modern Physics.

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different olours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source – Na light.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by magnetic focusing.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

Text and Reference Books

S. NO	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Advanced practical physics for students	B.l. Flint & h.t. Worsnop, 1971	Asia publishing house..
2	Advanced level physics practicals	Michael nelson and jon m. Ogborn, 4th edition, reprinted 1985	Heinemann educational publishers.
3	A text book of practical physics	Indu prakash and ramakrishna, 11th edition, 2011,	Kitab mahal, new delhi.

Course Code	**MAT301**
Course Title	**Matrices**
Type of course	Discipline elective
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Mathematics as one core subject
Course Objective	To provide an introduction to Basic concept of Matrices and Matrix Transformation in geometric
Course outcome	CO1 Student should be able to know the concept of Linear Independence and examples of different bases. CO2 Student should be able to presents the matrix form of basic geometric transformations and interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces. CO3 Students will be able to use elementary row operations to reduce matrices into echelon forms and computation of matrix inverses by using elementary row operations.

UNIT I:

R, R^2, R^3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R^2, R^3. Translation, Dilation, Rotation, Reflection in a point, line and plane.

UNIT II:

Matrix form of basic geometric transformations. Interpretation of Eigen values and eigenvectors for such transformations and Eigen spaces as invariant subspaces. Matrices in diagonal form. Reduction to diagonal form up to matrices of order 3.

UNIT III:

Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices.

UNIT IV:

concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Introduction to Algebra*	A.I. Kostrikin	Springer Verlag
2	*Linear Algebra*	S. H. Friedberg	Prentice Hall of India Pvt. Ltd
3	Theory and Problems of Matrix Operations	Richard Bronson	Tata McGraw Hall

Course Code	**MAT303**
Course Title	**Linear Algebra**
Type of course	Discipline Elective Course
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Mathematics as one core subject
Course Objective	To have the knowledge of basic Quotient Space, linear Transformation , invertibility and Isomorphism
Course outcome	CO1 Students completing this course will be able to compute the inverse of an invertible matrix. CO2 Students completing this course will be able to find the null space of a matrix and represent it as the span of independent vectors. CO3 Students completing this course will be able to find the matrix representation of a linear transformation given bases of the relevant vector spaces.

UNIT I:

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

UNIT II:

Linear transformations, null space , range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

UNIT III:

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial**.**

UNIT IV:

Isomorphism's, Isomorphism theorems, invariability and isomorphism's, change of coordinate matrix.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Linear Algebra,*	Stephen H. Friedberg	Prentice-Hall of India
2	*Linear Algebra and its Applications*	David C. Lay	1. Pearson Education Asia, Indian
3	*Introduction to Linear Algebra*	S. Lang,	., Springer
4	*Linear Algebra and its Applications*	Gilbert Strang	Thomson

Course Code	CHM 305
Course Title	**Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR spectroscopy**
Type of course	Discipline Elective course (theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as one core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students about organometallic chemistry and organic spectroscopy.
Course outcome	CO1 Explain the synthesis, structure, bonding, properties and reactivity of both main group &transition metal organyls. CO2 Work to a professional level of skills in a chemical synthesis laboratory. CO3 Demonstrate effective report writing, experimental design and data analysis.

UNIT I

Chemistry of 3d metals : Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $[Fe(CN)_6]$, Sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

UNIT -II

Organometallic Compounds Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – II

Bio-Inorganic Chemistry: A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na +,K+,Mg2+ ions, Na/K pump; Role of Mg2+ions in energy production and chlorophyll. Role of Ca2+in blood clotting, stabilization of protein structures and structural role (bones). Polynuclear and heteronuclear aromatic compounds: Properties of the following compounds with reference to electrophilic and Nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine.

Active methylene compounds: Preparation: Claisen ester condensation. Keto-enol tautomerism. Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having

UNIT IV

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λmax& εmax , chromophore, auxochrome, bathochromic and hypsochromic shifts, Solvent Effect in UV and IR Spectroscopy. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β–unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Concise Inorganic Chemistry	1.D. Lee	ELBS
2.	Inorganic Chemistry: Principles of Structure and Reactivity	James E. Huheey, Ellen Keiter & Richard Keiter	Pearson Publication.
3.	Bioinorganic Chemistry	Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine	Viva Books Pvt. Ltd., New Delhi (1998
4.	Biological Inorganic Chemistry: An Introduction	Robert Crichton	.Elsevier Science (2008)
5.	Biological Inorganic Chemistry: Structure and Reactivity	Harry B. Gray, Edward I. Stiefel et al.,	University Science Books.
6.	Inorganic Chemistry	G.L. Miessler & Donald A. Tarr	Pearson Publication.
7.	Basic Inorganic Chemistry	F.A. Cotton & G. Wilkinson:	John Wiley & Sons
8.	Shriver & Atkin's Inorganic Chemistry (5th Edition),	P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman	Oxford University Press,
9.	Organic Chemistry (Vol. I & II),	I.L. Finar	E.L.B.S.
10.	Applications of Absorption Spectroscopy of Organic Compounds,	John R. Dyer:	Prentice Hall.
11.	Spectroscopic Identification of Organic Compounds	R.M. Silverstein, G.C. Bassler & T.C. Morrill	John Wiley & Sons
12.	Organic Chemistry,	R.T. Morrison & R.N. Boyd	Prentice Hall.
13.	A Guide Book to Mechanism in Organic Chemistry	Peter Sykes:	Orient Longman.

Course Code	CHM 307
Course Title	**Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy**
Type of course	Discipline elective(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as one core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about organometallic chemistry and organic qualitative analysis.
Course outcome	CO1 Interpret the structures of various complexes and understand their properties. CO2 Impart knowledge about handling the apparatus for various experiments. CO3 Employ spectroscopy for characterization of metal complexes.

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+}
Or
Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}.

2. Preparation of any two of the following complexes and measurement of their conductivity:
(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxala toferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$
Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	A.I. Vogel , G Svehla	Prentice Hall
2	Vogel's Quantitative Chemical Analysis (6^{th} Edition),	A.I. Vogel , J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
3	Advanced Practical Inorganic	Ayodha Singh	Campus Books 2002

	Chemistry		
4	Textbook of Practical Organic Chemistry, 5th edition, 1996.	Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G	Prentice-Hall
5	Practical Organic Chemistry	Mann, F.G. & Saunders, B.C.	Orient-Longman,

Course Code	**CHM 309**
Course Title	**Industrial Chemical and Environment**
Type of course	Discipline elective(Theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective	The aim of this course is to impart theoretical knowledge to the students in Industrial processes and environmental chemistry.
Course outcome	CO1 Understand the vital role played by chemistry in industry. CO2 Give solution based on chemical knowledge in the field of various industries. CO3 Use modern instrumentation techniques for chemical analysis and sepration.

UNIT I

Industrial Gases and Inorganic Chemicals Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling th efollowing chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

UNIT II

Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology. Environment and its segments Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO_2, CO_2 , CO, NOx, H_2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

UNIT III

Water Pollution**:** Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their

treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

UNIT IV

Energy & Environment: Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

BiocatalysisIntroduction to biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Standard methods for the examination of water and waste water- 19th Edn. 1995.	Andrew D. Eaton, Lenore, S. Clesceri and A. E. Greenberg,	EPS group, INC Roman,
2	Environmental Chemistry, , 2nd edition, 1990.	A. K. DE	Wiley Eastern Ltd
3	Environmental Pollution Analysis, 1995	S. M. Khopkar,	Wiley Eastern Ltd.,
4	Physical Electrochemistry- Fundamentals, Techniques and Applications	Eliezer Gileadi,	Wiley-VCH 2011.
5	Waste water treatment disposal and release-, INC second Edn., 1990.	Metcalf and eddy	Tata Mc Graw Hill
6	Environmental pollution control and engineering, 1995.	C. S. Rao	Wiley Eastern Ltd.
7	Chemical and Biological methods for water pollution studies, 1986.	R. K. Trivedy, and P. K. Goel,	Environmental publications
8	Environmental Chemistry, 1994.	B. K. Sharma & H. Kaur	Goel publishing House,
9	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.

Course Code	**CHM 311**
Course Title	**Industrial chemical and environment**
Type of course	Discipline elective(practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Chemistry as one core subject
Course Objective	The aim of this course is to impart practical knowledge to the students in Industrial processes and environmental chemistry.
Course outcome	CO1 Work to a professional level of skills in a chemical synthesis laboratory. CO2 Undertake hands on lab work & develop problem solving abilities required for successful career in pharmaceutical ,chemical industries, teaching research,cosmetics industries and petrochemicals sector. CO3 Get information about certain drugs and their side effects.

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO3 and potassium chromate).
6. Estimation of total alkalinity of water samples ($CO3^{2-}$, $HCO3^{-}$) using double titration method.
7. Measurement of dissolved CO_2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Standard methods for the examination of water and waste water- 19th Edn. 1995.	Andrew D. Eaton, Lenore, S. Clesceri and A. E. Greenberg,	EPS group, INC Roman,
2	Environmental Pollution Analysis, 1995	S. M. Khopkar,	Wiley Eastern Ltd.,
3	Physical Electrochemistry-Fundamentals, Techniques and	Eliezer Gileadi,	Wiley-VCH 2011.

	Applications		
4	Waste water treatment disposal and release-, INC second Edn., 1990.	Metcalf and eddy	Tata Mc Graw Hill
5	Environmental pollution control and engineering, 1995.	C. S. Rao	Wiley Eastern Ltd.
6	Chemical and Biological methods for water pollution studies, 1986.	R. K. Trivedy, and P. K. Goel,	Environmental publications
7	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.

SEMESTER VI

Communication Skills and Personality Development

Course Code	**ENG004**
Course Title	**Communication Skills and Personality Development**
Type of course	**ID**
L T P	2 0 2
Credits	3 0 0
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent
Course objective	Main objective of the extension subject is to introduce the students to communication skills and personality development.
Course Outcome	Students will use their communication skills and personality effectively.

Theory

UNIT-1 Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication.

UNIT-1I

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

UNIT-III

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting.

UNIT-1V

Individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical

1. Listening and note taking, writing skills, oral presentation skills.
2. Field diary and lab record; indexing, footnote and bibliographic procedures.
3. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agriculture Demonstration and Extension Communication	Ram Krishan	P S Jayasinghe Asia Publishing House
2	Communication Skills and Personality Development		Kalyani Publishers. Ludhiana,
3	Communication Skills and Personality Development		Nirali Prakashan

Course Code	**PHY302**
Course Title	**Solid state physics**
Type of course	Discipline elective(theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective	The subject will add one more step to the students of first year in the fields of magnetism, electromagnetic theory, & properties of matter.
Course Outcome	CO1 They have Basic understanding of symmetry and thermodynamic properties of solid state systems . CO2 Analyze the success and failure of free electron theory, the origin of band gap and Hall effect. CO3 Enable transition from theoretical physical subjects towards the basic properties of solid state.

UNIT I

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law

UNIT II

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

UNIT III

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons.

UNIT IV

Elementary band theory: Kronig Penny model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient. Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.

Text and reference books

S. No	Name	Author(s)	Publisher
1	*Introduction to solid state physics*	Charles kittel, 8th ed., 2004,	Wiley india pvt .ltd.
2	*Elements of solid state physics*	J.p. Srivastava, 2nd ed., 2006,	Prentice-hall of india .
3	*Introduction to solids*	Leonid v. Azaroff, 2004,	Tata mc-graw hill.
4.	*Solid state physics*	Neil w. Ashcroft and n. David mermin, 1976,	Cengage
5.	*Learning solid state physics*	Rita john, 2014	Mcgraw hill

Course Code	**PHY304**
Course Title	**Solid state physics**
Type of course	Discipline elective(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The course is to impart practical knowledge to the students and provide them with practical exposure of electricity and magnetism.
Course Outcome	CO1 Enable to evaluate advanced research articles of solid state physics. CO2 They have critical thinking about review of the paper. CO3 They effectively communicate scientific ideas via writing and speaking.

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
9. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 ^{o}C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.

TEXT AND REFERENCE BOOKS

S. NO	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	*Advanced practical physics for students*	B.l. Flint and h.t. Worsnop, 1971	Asia• publishing house
2	*Advanced level physics practicals,*	J michael nelson and jon m. Ogborn, 4th edition,• reprinted 1985,	Heinemann educational publishers
3	*A text book of practical physics,*	Indu prakash and ramakrishna, 11th ed., 2011	,• kitab mahal, new delhi

4.	*Elements of solid state physics*	J.p. Srivastava, 2nd ed., 2006	J.p. Srivastava, 2nd ed., 2006

Course Code	**PHY306**
Course Title	**Quantum mechanics**
Type of course	Discipline elective (theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is just to impart theoretical knowledge to the students with the one more important subject of physics, named as quantum mechanics. This is addition in the knowledge of mechanics at micro-state level
Course Outcome	CO1 They have understanding about the central concepts and principles in quantum mechanics. CO2 Enable to solve the Schrödinger equation on their own for simple systems in one to three dimensions. CO3 They understand both analytic and numerical solutions in quantum mechanics.

UNIT I

Time dependent Schrodinger equation: Time dependent Schrodinger equation ,Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle

UNIT II

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method.

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers;; Orbital angular momentum quantum numbers land m; s, p, d,.. shells (idea only)

UNIT III

Atoms in Electric and Magnetic Fields:- Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton

UNIT IV

Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect.Many electron atoms:- Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings.

Text and reference books

S. No	Name	Author(s)	Publisher
1	A Text book of Quantum Mechanics	P.M. Mathews & K. Venkatesan, 2nd Ed., 2010	McGraw Hill
2	Quantum Mechanics	Robert Eisberg and Robert Resnick, 2ndEdn., 2002	Wiley.
3	Quantum Mechanics	Leonard I. Schiff, 3rdEdn. 2010,	Tata McGraw Hill
4.	Quantum Mechanics	G. Aruldhas, 2ndEdn. 2002,	PHI Learning of India
	Quantum Mechanics	Bruce Cameron Reed, 2008,	Jones and Bartlett Learning.

Course Code	**PHY308**
Course Title	**Quantum mechanics**
Type of course	Discipline elective(practical)
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is just to impart practical knowledge to the students with the one more important subject of physics, named as quantum mechanics. This is addition in the knowledge of mechanics at micro-state level
Course Outcome	CO1 They familiar to discuss and interpret experiments that reveal the wave properties of matter. CO2 They have developed ability for independent analytical work in physics through a project. CO3 Enable for new approximation methods and other developments, especially in the field of scattering.

1.Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom.

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take e = 3.795 $(eVÅ)^{1/2}$, ħc = 1973 (eVÅ) and m = $0.511x10^6 eV/c^2$.

2.Solve the s-wave radial Schrodinger equation for an atom

here m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

Find the energy (in eV) of the ground state of the atom to an accuracy of threesignificant digits. Also, plot the corresponding wavefunction. Take e = 3.795 $(eVÅ)^{1/2}$, m = $0.511x10^6 eV/c^2$, and a = 3 Å, 5 Å, 7 Å. In these units ħc = 1973(eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

3.Solve the s-wave radial Schrodinger equation for a particle "For the anharmonic oscillator potential for the ground state energy (in MeV) of the particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose m = 940 MeV/c^2, k = 100 MeV fm^{-2}, b = 0, 10, 30 MeV fm^{-3} In these units, cħ = 197.3 MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4 Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:!!! – !!!! , – !

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function.

Take: m = 940x10^{6}eV/C^2, D = 0.755501 eV, α = 1.44, r_o = 0.131349 Å

Laboratory based experiments:

1. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency

2. Study of Zeeman effect: with external magnetic field; Hyperfine splitting

3.To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

Text and reference books

S. No	Name	Author(s)	Publisher
1	Schaum's outline of programming with c++	J.hubbard, 2000	Mcgraw hill
2	. Numerical recipes in c: the art of scientific computing ,	W.h.press et al.,• 3rdedn., 2007,	Cambridge university press
3	A guide to matlab,	B.r. hunt, r.l. lipsman, j.m. rosenberg, 2014, 3rd edn.	Cambridge university press

Course Code	**PHY310**
Course Title	**Nuclear & Particle Physics**
Type of course	Discipline Elective (Theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective (CO)	The aim of this course is just to impart theoretical knowledge to the students with the one more important subject of physics, named as nuclear physics
Course Outcome	CO1 They have experience of nuclear structures and dynamics, as well as nuclear reactions . CO2 They can calculate the kinematics of various reactions and decay processes by relativistic calculations. CO3 Evaluate radiation energy losses by passage through matter.

UNIT I

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties **,**quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding **,**energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.Nuclear Models: Liquid drop model approach, semi empirical mass formula and Significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermions gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

UNIT II

Radioactivity decay: (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

UNIT III

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. Detector for Nuclear Radiations**:** Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation 32 Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si & Ge) for charge particle and photon detection (concept of charge carrier and mobility).

UNIT IV

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons. Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

TEXT AND REFERENCE BOOKS

S. NO	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Introductory nuclear Physics	Kenneth S. Krane .	Wiley (1978)
2	Concepts of nuclear physics	Bernard L. Cohen.	Tata Mcgraw Hill, 1998
3	Radiation detection and measurement	G.F. Knoll	John Wiley & Sons, 2000
4.	Quarks and Leptons	F. Halzen and A.D. Martin,	Wiley India, New Delhi

Course code	**PHY312**
Course Title	**Nuclear & Particle Physics**
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc Ist, IInd with Physics as one core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about the counters.
Course Outcome	CO1 They have new ideas from fundamental research of nuclear physics is used in medicine. CO2 They can express alpha ,beta and gamma decay and conservation laws of nuclear physics. CO3 Enable to gain knowledge on particle detectors and accelerators.

1.To draw the plateau of a GM counter and find its dead time.
2.To study the statistical fluctuations and end point energy of beta particles using GM counter.
3.To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.
4.To study Gaussian distribution using G.M. counter.
5.To determine the Source strength of a beta source using G.M. counter.
6.Study of Poisson distribution using GM counter.
7.To calibrate the scintillation counter using a known Gamma Source.
8.To study absorption of gamma radiation by scintillation counter.

TEXT AND REFERENCE BOOKS

S. NO	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Introductory nuclear Physics	Kenneth S. Krane .	Wiley (1978)
2	Concepts of nuclear physics	Bernard L. Cohen.	Tata Mcgraw Hill, 1998
3	Radiation detection and measurement	G.F. Knoll	John Wiley & Sons, 2000

Course Code	**MAT302**
Course Title	**Integral Calculus**
Type of course	Discipline Elective
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Mathematics as one core subject
Course Objective (CO)	.It help to students Understand partial Integration
Course Outcome	CO1 Student will be able to evaluate the integration of rational and irrational functions and to evaluate the reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations. CO2 Students will be able to find the areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. CO3 Students will be able to find the double and triple integration.

UNIT I:

Integration by Partial fractions, integration of rational and irrational functions.

UNIT II:

Integration of definite integrals. Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations.

UNIT III:

Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution.

UNIT IV:

Double and Triple integrals.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Calculus*,	G.B. Thomas and R.L. Finney	Pearson Education
2	*Calculus*	H. Anton, I. Bivens and S. Davis	John Wiley and Sons

Course Code	**MAT306**
Course Title	**Complex Analysis**
Type of course	Discipline Elective
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Mathematics as one core subject
Course Objective (CO)	It develops the knowledge Analytic function ,derivative function and Cauchy-Riemann equation
Course Outcome	CO1 Students will have the knowledge and skills to explain the fundamental concepts of complex analysis and their role in modern mathematics and applied contexts. CO2 Students will be able to demonstrate accurate and efficient use of complex analysis techniques. CO3 Students will be able to express analytic functions in terms of power series and Laurent series and also calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem.

UNIT I:

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

UNIT II:

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.

UNIT III:

Cauchy-Goursat theorem, Cauchy integral formula.Liouville's theorem and the fundamental theorem of algebra.

UNIT IV:

Convergence of sequences and series, Taylor series and its examples.Laurent series and its examples, absolute and uniform convergence of power series.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Complex Variables and Applications*	James Ward Brown and Ruel V. Churchill	Hill International Edition
2	*Complex analysis*	Joseph Bak and Donald J. Newman	Springer-Verlag New York

Course Code	MAT308
Course Title	**Linear Programming**
Type of course	Discipline Elective
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc Ist, IInd with Mathematics as one core subject
Course Objective	It help to students Understand Simplex Method ,Big M Method and Primal – dual Relationship.
Course Outcome	CO1 The field of linear programming provides the appropriate methods for the efficient computation of optimal solutions of a problem which is modeled by a linear objective function and a set of linear constraints. CO2 Students will be ready to model a problem as a linear programming problem and to apply the appropriate method in order to find an optimal solution. CO3 Students should be able to identify parametersthat will influence the optimal solution of an Linear programming problem and derive feasible solution using atechnique of operational research.

UNIT I:

Linear Programming Problems, Graphical Approach for Solving some Linear Programs. Convex Sets, Supporting and Separating Hyper planes.

UNIT II

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format

UNIT III:

Introduction to artificial variables two-phase method, Big-M method and their comparison.

UNIT IV:

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual, sensitivity analysis.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Linear programming and Network flows*	Mokhtar S. Bazaraa	John Wiley and Sons
2	*Linear programming*	Mokhtar S. Bazaraa	Tata McGraw Hill

Course Code	CHM 306
Course Title	**Chemistry of Main Group Element, Theories of Acids and Bases**
Type of course	Discipline Elective Course(Theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in Main group elements.
Course Outcome	CO1 To be able to represent covalent and ionic bonding using Lewis dot structure. CO2 Able to determine whether a bond is metallic, ionic, covalent or polar covalent. CO3 To determine different reactions of acid and base.

UNIT I

Acids and Bases Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process
General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

UNIT II

s- and *p*-Block Elements Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale).General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature.Oxidation states of *s*- and *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of *s* block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and

their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

UNIT III

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable: Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH3), 14, 15, 16 and 17.Oxides

UNIT IV

Noble gases: Rationalization of inertness of noble gases, catharses, preparation and properties of XeF2, XeF4 and XeF6 ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory. Inorganic Polymers Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$. of N and P, Ox acids of P, S and Cl. Halides and ox halides of P and S (PCl3, PCl5, SOCl2 and SO2Cl2). Interhalogen compounds. A brief idea of pseudo halides.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Inorganic Chemistry Principles of Structure and Reactivity	J.E. Huheey	Harper Inter science
4	Principles of Inorganic Chemistry	Puri, Sharma and Kalia	Vishal publishers
5	Synthesis and Technique in Inorganic chemistry	G. S.Girlomi; R.J. Angleci	Latest edition, University Science Books.
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd
7	Shriver & Atkin's Inorganic Chemistry (5^{th} Edition),	P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman	Oxford University Press,

Course Code	CHM 308
Course Title	**Chemistry of Main Group Element, Theories of Acids and Bases**
Type of course	Discipline Elective Course(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students in qualitative and quantitative inorganic analysis..
Course Outcome	CO1 To determine different types of acids base titrations. CO2 To be able to understand the how solution standarize. CO3 Cabiliration of instruments.

1. Iodometric estimation of potassium dichromate and copper sulphate

2. Iodimetric estimation of antimony in tartaremetic

3. Estimation of amount of available chlorine in bleaching powder and household bleaches

4. Estimation of iodine in iodized salts.

5. Iodimetric estimation of ascorbic acid in fruit juices.

6. Estimation of dissolved oxygen in water samples.

7. Gravimetric estimation of sulphate as barium sulphate.

8. Gravimetric estimation of aluminium as oximato complex

9. Preparation of the following :potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic	G Svehla	Prentice Hall

	Analysis (7th Edition). ISBN-13:978-0582219666,		
2	Vogel's Quantitative Chemical Analysis (6th Edition), ISBN-13:978-0582226289,	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
3	Advanced Practical Inorganic Chemistry	Ayodha Singh	Campus Books 2002

Course Code	**CHM 310**
Course Title	**Green Chemistry**
Type of course	Discipline Elective Course(Theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students Green chemistry and applications of green chemistry in organic synthesis.
Course Outcome	CO1 Identify various chemicals present in the environment and their effects on living beings. CO2 Observe the current environmental issues and various ways of solving the same. CO3 Identify major threatened areas of environment and their appropriate solutions by chemical approach.

UNIT I

Introduction to Green Chemistry: What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Principles of Green Chemistry and Designing a Chemical synthesis**:** Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:
Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products , Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy.

UNIT II

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.
Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups. Catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.
Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical process

UNIT III

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction

3. Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)

4 Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments.

5 Designing of Environmentally safe marine antifoulant.

UNIT IV

Future Trends in Green Chemistry Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry	V. K. Ahluwalia	New Age International
2	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. & Warner, J.K.	Oxford University Press
3	Introduction to Green Chemistry,2001	Matlack, A.S.	Marcel Dekker
4	Real-World cases in Green Chemistry, 2000	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington
5	Introduction to Green Chemistry,2002	Ryan, M.A. & Tinnesand, M.	American Chemical Society, Washington
6	Green Chemistry Experiments: A monograph	Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K.	I.K. International Publishing House Pvt Ltd. New Delhi

Course Code	**CHM 312**
Course Title	**Green Chemistry**
Type of course	Discipline Elective Course(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students green methods of synthesis.
Course Outcome	CO1 Understand types of calibration procedures. CO2 Estimate various factors responsible for contamination of water. CO3 Apply concepts learned in chemistry and correlate with real world scenario.

1. Safer starting materials: Preparation and characterization of nanoparticles of gold using tea leaves.
2. Using renewable resources: Preparation of biodiesel from vegetable/ waste cooking oil.
3. Avoiding waste: Principle of atom economy. Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
   Preparation of propene by two methods can be studied
   Triethylamine ion + OH^- → propene + trimethylpropene + water
   H_2SO_4/□
   (II) 1-propanol ⟶ propene + water

   Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.
4. Use of enzymes as catalysts Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
5. Alternative Green solvents Extraction of D-limonene from orange peel using liquid CO2 prepared form dry ice. Mechanochemical solvent free synthesis of azomethines.
6. Alternative sources of energy: Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II). Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry	V. K. Ahluwalia	New Age International
2	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. & Warner, J.K.	Oxford University Press
3	Introduction to Green Chemistry,2001	Matlack, A.S.	Marcel Dekker
4	Real-World cases in Green Chemistry, 2000	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington
5	Introduction to Green Chemistry,2002	Ryan, M.A. & Tinnesand, M.	American Chemical Society, Washington
6	Green Chemistry Experiments: A monograph	Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K.	I.K. International Publishing House Pvt Ltd. New Delhi
7	Green Chemistry: An introductory text	Lancaster, M.	RSC publishing, 2nd Edition.

Course Code	**CHM 314**
Course Title	**Analytical Method in Chemistry**
Type of course	Discipline Elective Course(theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in analytical methods in chemistry.
Course Outcome	CO1 Explain the concept of spectroscopy with industrial and research application. CO2 Develop experience and knowledge to operate and use effectively the analytical tools and instruments available in laboratory. CO3 Understand the significance, quality and limitations of the results produced by various separation techniques.

UNIT I

Qualitative and quantitative aspects of analysis: Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

UNIT II

Infrared Spectrometry: Basic principles of instrumentation (choice of source, NM monochromatic & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution. Flame Atomic Absorption and Emission Spectrometry: Basic principles of

instrumentation (choice of source, monochromatic, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III

Thermal methods of analysis: Theory of thermogravimetry (TG), basic principle of instrument Techniques for quantitative estimation of Ca and Mg from their mixture .

Electro-analytical methods: Classification of electro analytical methods, basic principle of pH metric, potentiometric and conduct metric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

UNIT IV

Separation techniques: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6^{th} Edition),	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
6	Instrumental Analysis	G.D. Christian and J.E.G. Reily	Allegn Becon, Latest edition
7	Instrumental Methods of Chemical	G.W.Ewing,	McGraw Hill Pub, 1975.

Course Code	CHM 316
Course Title	**Analytical Method in Chemistry**
Type of course	Discipline Elective(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about analytical methods of chemical analysis .
Course Outcome	CO1 Apply appropriate separation methods to the analysis real world problems. CO2 Understand various types of titrations i.e redox, colorimetric, complexometric and acid- base titration. CO3 Apply concepts learned in chemistry and correlate with real world scenario.

I. Separation Techniques

Chromatography:

(i) Separation of mixtures : Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}.

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

(iii) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.

(iv) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+}- DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

(iii) Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt
(iii) Estimation of calcium, magnesium, phosphate, nitrate

Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
(ii) Separation of metal ions from their binary mixture.
(iii) Separation of amino acids from organic acids by ion exchange chromatography.

III Spectro-photometry

(i) Determination of pKa values of indicator using spectrophotometry.
(ii) Structural characterization of compounds by infrared spectroscopy.
(iii) Determination of dissolved oxygen in water.
(iv) Determination of chemical oxygen demand (COD).
(v) Determination of Biological oxygen demand (BOD).

Text and Reference Books

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1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6^{th} Edition),	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
6	Instrumental Analysis	G.D. Christian and J.E.G. Reily	Allegn Becon, Latest edition
7	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.