SCHEME & SYLLABUS
B.Sc Non-Medical

(3 year programme)

Department of Physical Sciences
University Institute of Sciences (UIS)
Sant Baba Bhag Singh University
2022

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 and to contribute substantially to the goal of SBBSU and becoming a 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.

Student centric, ICT enabled and interactive teaching, outcome based teaching model comprising of theoretical work, regular academic activities such as research projects, seminars, resource learning and hands-on laboratory work.

The Department wishes to focus on providing a comprehensive curriculum at undergraduate and postgraduate levels with teaching-learning adjunct to cater the need of industry, relevant research and career opportunities, meritorious careers in academia and proficient industries. Our research oriented teaching paves the way for entry into different careers since it equips students with advanced transferable skills in information gathering, analysis and presentation, which are vital tools in the field of science.

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.
- The department updates curricula on a regular basis to ensure that students keep up with the changing trends of education and research globally. The syllabi of courses are designed to equip students to qualify exams such as GATE, UGC- NET / SLET, TIFR etc.
- The Department has well equipped laboratories with a number of instruments and facilities like, UV- Visible Spectrophotometer, High Speed Centrifuge, Muffle furnance, Digital water bath, Polarimeter, Ultrasonic interferometer, Ballistic Galvanometer **,** Deflection and vibration Magnetometer **,** Electron spin resonance, Turbiditimeter, Abbs Refractrometer, Digital weighing balance/ Spring balance, Magnetic plate with stirrer, pH meter, Conductometer, Flame Photometer, colorimeter and a double distillation plant etc.
- Students and teachers participation in International, National, State and Regional seminars and conferences. Along with Industry aligned academia, expert interaction is the key features of the department.
- Curricular and the co-curricular activities are well balanced in the Teaching Learning environment to provide holistic education to the students.
- 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.

BSc. Non medical (Bachelor of Science in Non Medical)

(3 yearProgramme):

B.ScNon Medicalis a three year undergraduate programme. This course is fundamentally based on the basic principles of scientific studies namely Mathematics, Physics, Chemistry for the synthesis, analysis and data interpretations. Knowledge of these basic sciencesis an intergral component for the understanding the concepts and phenomenon of natural processes as well as applications of basic sciences help students to understand fundamental laws of nature.

VISION

To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.

MISSION

- Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research.

- To explore and advance new frontiers in physical sciences and integration with interdisciplinary sciences through visionary research for the benefit of society.
- To develop graduates for life-long learning and professional growth.

ELIGIBILITY CRITERIA

10+2 with Physics, Chemistry & Mathematics with 50% marks (45% marks in case of **SC**/ST candidates) in aggregate or equivalent grade.

DURATION

3 Years

CAREER PATHWAYS

Areas that offer jobs for B.Sc. degree holder are: -Education, College, Universities, Research firms, Environmental management and conservation, Forest services, Chemical industry, Biotechnology, Pharmaceutical companies, Geological survey department, Wastewater plants, Testing laboratories, Engineering firms, Oil Companies, 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 Jobs: After B.Sc (Non Medical) student can do B.Ed, M.Sc.

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 constructs a bridge between the theoretical and practical aspects of Physical Sciences & inculcates 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)

PO1.Disciplinary Knowledge: Students will be able to understand specialised areas and explain major concepts in the Physical sciences and its applications.
PO2: Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems in Physical Sciences (Physics, Chemistry & Mathematics).
PO3: Problem Solving: The student will be well-equipped to solve complex problems of numericals related to Physics/ Chemistry & Mathematics that are best approached with critical thinking.
PO4: Practical skills: Student will be able to demonstrate the ability to read, understand, and critically review scientific information.
PO5: Modern Tool Usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in laboratory work creates this attribute.
PO6: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is “welcoming for all students".

PO7: Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8: Research related skills & Ethics: Students will be able to motivate and communicate scientific knowledge in oral and written form accurately using a range of formats.
PO9:Self-directed Learning: Students are encouraged to accept challenges in Physical Sciences by information available to them. Various activities/advanced ideas equip the students to find relevant information and educate themselves.
PO10: Individual and Team Work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethics and goals.
PO11: Communication Skills: Effective communication is a much desirable attribute across courses. However, a Physics, Chemistry and Mathematics student is expected to assimilate technical information about Physics, Chemistry and Mathematics from various sources and convey it to intended audience both orally and in writing in an intelligible manner.
PO12: Life long Learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning problem solving, critical thinking etc. make the students lifelong learners.

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.

CURRICULUM STRUCTURE

B.Sc.(Non Medical) degree programme will have a curriculumwith Syllabi consisting of following type of courses:

I. **Core Courses (CR):** A course, which should compulsorily by studiedby 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/ analyzing/exploring a real-life situation/ difficult problem.

II. **Elective Courses:** Elective course is generally a course which can be chosen from a pool of courses and which may be very specific or specialized or 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 SpecificElective.

B. Project (I): An elective course designed to acquire special/advanced knowledge, such as supplement study/support study toa project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

III. **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.

IV. 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.

2. NOMENCLATURE USED:

A. Graduate Core Courses
i. Core Courses. (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)

Index

CHEMISTRY COURSES				
Core Courses (semester-I to IV)				
S.No	**Subject Code**	**SubjectName**	**Semester**	**Page number**
1.	**CHM101**	Atomic Sructures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons	Semester-I	36-37
2.	**CHM 103**	Atomic Structures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons (Practical)	Semester-I	38
3.	**CHM 102**	Chemical Energetic Equilibria and Functional Group Organic Chemistry -I	Semester-II	40-41
4.	**CHM 104**	Chemical Energetic Equilibria and Functional Group Organic chemistry-I (Practical)	Semester-II	42
5.	**CHM 201**	Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II	Semester-III	44-45
6.	**CHM 203**	Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II(Practical)	Semester-III	46-47
7.	**CHM 202**	Transition Metal & Coordination chemistry, States of Matter & Chemical Kinetics	Semester-IV	49-50
8.	**CHM 204**	Transition Metal & Coordination chemistry, States of matter & Chemical kinetics (Practical)	Semester-IV	51
Discipline Subject Elective courses (semester-V,VI) Any two of each subject in both semesters				
9.	**CHM301**	Molecules of Life	Semester-V	54-55
10.	**CHM303**	Molecules of Life (Practical)	Semester-V	56
11.	**CHM 305**	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	Semester-V	57-58
12.	**CHM 307**	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (Practical)	Semester-V	59
13.	**CHM 309**	Industrial chemicals and Environment	Semester-V	60-61
14.	**CHM 311**	Industrial chemicals and Environment (Practical)	Semester-V	62
15.	**CHM 306**	Chemistry of main group elements, theories of acids and bases	Semester-VI	64-65
16.	**CHM 308**	Chemistry of main group elements, theories of acids and bases (Practical)	Semester-VI	66
17.	**CHM310**	Green Chemistry	Semester-VI	67-68
18.	**CHM312**	Green Chemistry (Practical)	Semester-VI	69-70
19.	**CHM 314**	Analytical method in chemistry	Semester-VI	71-72
20.	**CHM 316**	Analytical method in chemistry (Practical)	Semester-VI	73-74
21.	**CHM320**	Inorganic Materials of Industrial Importance	Semester-VI	75-76
22.	**CHM322**	Inorganic Materials of Industrial Importance Practical	Semester-VI	77
Skill enhancement courses (semester-III to VI)				
23.	**CHM 209**	Basic Analytical chemistry	Semester-III	79-80
24.	**CHM210**	Green Methods in Chemistry	Semester-IV	81
25.	**CHM 313**	Fuel Chemistry	Semester-V	82-83
26.	**CHM 318**	Pharmaceutical Chemistry	Semester-VI	84-85
27.	**CHM324**	Chemistry of Cosmetics and Perfumes	Semester-VI	86

24	**PHY320**	Practical Training	Semester-III-VI	122

Course Scheme for B.Sc. Non Medical

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	PHY101	Mechanics	4:0:0	4:0:0	4	4
2	CR	CHM101	Atomic Structure,Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4:0:0	4:0:0	4	4
3	CR	MAT101	Calculus and Matrices	5:1:0	5:1:0	6	6
4	AECC	ENG121	Communication Skill-I	2:0:0	2:0:0	2	2
5	SEC	PT101/PT103/PT105	NSO/NCC/NSS	2:0:0	Non-credit	2	NC

II. Practical Subjects

1	CR	PHY103	Mechanics(Practical)	0:0:4	0:0:2	4	2
2	CR	CHM103	Atomic Structure, Bonding, General Organic Chemistry &Aliphatic Hydrocarbons (Practical)	0:0:4	0:0:2	4	2
3	AECC	ENG123	Communication Skill-I Lab	0:0:2	0:0:1	2	1
	Total					**28**	**21**

Total Contact Hours: 28

Total Credit Hours: 21

CR- Core Course

AEC-Ability Enhancement Compulsory Courses

SEC-Skill Enhancement Courses

Course Scheme for B.Sc.Non Medical

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	PHY102	Electricity and Magnetism	4:0:0	4:0:0	4	4
2	CR	CHM102	Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I	4:0:0	4:0:0	4	4
3	CR	MAT102	Differential Equations	5:1:0	5:1:0	6	6
4	AECC	ENG114	Communication Skill-II	2:0:0	2:0:0	2	2
5	SEC	PT102/PT104/PT106	NSO/NCC/NSS	2:0:0	Non-credit	2	NC

II. Practical Subjects

1	CR	PHY104	Electricity andMagnetism (Practical)	0:0:4	0:0:2	4	2
2	CR	CHM104	Chemical Energetics,Equilibria & Functional Group Organic Chemistry-I (Practical)	0:0:4	0:0:2	4	2
3	AECC	ENG116	Communication Skill-II Lab	0:0:2	0:0:1	2	1
	Total					**28**	**21**

Total Contact Hours: 28

Total Credit Hours: 21

CR- Core Courses

AECC-Ability Enhancement Compulsory Courses

SEC-Skill Enhancement Courses

Course Scheme for B.Sc. Non Medical

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	PHY201	Thermal Physics	4:0:0	4:0:0	4	4
2	CR	CHM201	Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II	4:0:0	4:0:0	4	4
3	CR	MAT201	Real Analysis	5:1:0	5:1:0	6	6
4	AECC	EVS001	Environmental Science	3:0:0	3:0:0	3	3
5	SEC-I	PHY205 CHM209 MAT207	Elective subject (Skill Enhancement Course)-I(any one of the following) Physics Workshop Skill Basic Analytical chemistry Logic and Graph Theory	2:0:0	2:0:0	2	2

II. Practical Subjects

1	CR	PHY203	Thermal Physics (Practical)	0:0:4	0:0:2	4	2
2	CR	CHM203	Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II (Practical)	0:0:4	0:0:2	4	2
	Total					**27**	**23**

Total Contact Hours: 27

Total Credit Hours: 23

CR- Core Course

AECC-Ability Enhancement Compulsory Courses

SEC-Skill Enhancement Course

CourseScheme for B.Sc. Non Medical
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	PHY202	Waves and Optics	4:0:0	4:0:0	4	4
2	CR	CHM202	Transition Metal & Coordination Chemistry, States of Matter & Chemical Kinetics	4:0:0	4:0:0	4	4
3	CR	MAT202	Algebra	5:1:0	5:1:0	6	6
4	AECC	SSC001	Gender Equity	3:0:0	3:0:0	3	3
5	SEC-II	PHY206 CHM210 MAT208	Elective subject (Skill Enhancement Course)-II(any one of the following) Electric Circuits and Network Skills Green Methods in Chemistry Number Theory	2:0:0	2:0:0	2	2

II. Practical Subjects

1	CR	PHY204	Waves and Optics (Practical)	0:0:4	0:0:2	4	2
2	CR	CHM204	Transition Metal & 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

AECC-Ability Enhancement Compulsory Course

SEC-Skill Enhancement Course

Course Scheme for B.Sc. Non Medical

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	DSE-I	PHY301 PHY305	Discipline specific Elective course-I(any one of the following) Digital, analog Circuits and Instrumentation Elements of Modern Physics	4:0:0	4:0:0	4	4
2	DSE-I	CHM301 CHM305 CHM309	Discipline specific Elective course-I(any one of the following) Molecules of Life Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy : Industrial chemicals and Environment	4:0:0	4:0:0	4	4
3	DSE-I	MAT301 MAT303 MAT307	Discipline specific Elective course-I(any one of the following) Numerical Method Linear Algebra Theory of Equations	5:1:0	5:1:0	6	6
4	AECC	SSC006	Human values and professional ethics	3:0:0	3:0:0	3	3
5	SEC-III	PHY309 CHM313 MAT305	Elective subject(Skill Enhancement Course)-III(any one of the following) Renewable and Energy Harvesting Fuel Chemistry Vector Calculus	2:0:0	2:0:0	2	2

II. Practical Subjects

1	DSE-I	PHY303 PHY307	Discipline specific Elective Practical-I (any one of the following) Digital, analog Circuits and Instrumentation (Practical) Elements of Modern Physics (Practical)	0:0:4	0:0:2	4	2
2	DSE-I	CHM303 CHM307 CHM311	Discipline specific Elective Practical-I(any one of the following) Molecules of Life(Practical) Organometallic, BioinorganicChemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy(Practical) Industrial chemicals and Environment(Practical)	0:0:4	0:0:2	4	2
	Total					**27**	**23**

Total Contact Hours: 27

Total Credit Hours: 23

DSE-Discipline Specific Elective

SEC-Skill Enhancement Course

Course Scheme for B.Sc. Non Medical

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-II	PHY302 PHY306 PHY310 PHY316	Discipline specific Elective course-II(any oneof the following Solid State Physics Quantum Mechanics Nuclear & Particle Physics Embedded System: Introduction to Microcontroller	4:0:0	4:0:0	4	4
2	DSE-II	CHM306 CHM310 CHM314 CHM320	Discipline specific Elective course-II(any one of the following Chemistry of main group elements, theories of acids and bases Green Chemistry Analytical method in chemistry Inorganic Materials of Industrial Importance	4:0:0	4:0:0	4	4
3	DSE-II	MAT302 MAT306 MAT308	Discipline specific Elective course-II(any oneof the following) Integral Calculus Complex Analysis Introduction to operation Research	5:1:0	5:1:0	6	6
4	SEC-IV	PHY314 CHM318 CHM324 MAT310	Elective subject(Skill Enhancement Course)-IV(any one of the following) Radiology and Safety Pharmaceutical Chemistry Chemistry of Cosmetics and Perfumes Probability and Statistics	2:0:0	2:0:0	2	2
5	ID/SEC	CSE014	Basics of Computer Sciences	2:0:0	2:0:0	2	2

II. Practical Subjects

1	DSE-II	PHY304 PHY308 PHY312 PHY318	Discipline specific Elective Practical-II(any one of the following) Solid State Physics(Practical) Quantum Mechanics(Practical) Nuclear & Particle Physics(Practical) Embedded System: Introduction to Microcontroller(Practical)	0:0:4	0:0:2	4	2
2	DSE-II	CHM308 CHM312 CHM316 CHM322	Discipline specific Elective Practical-II(any one of the following) Chemistry of main group elements, theories of acids and bases (Practical) Green Chemistry(Practical) Analytical method in chemistry (Practical) Inorganic Materials of Industrial Importance (Practical)	0:0:4	0:0:2	4	2
3	ID/SEC	CSE016	Basics of Computer Sciences Lab	0:0:2	0:0:1	2	1
	Total					**28**	**23**

Total Contact Hours: 28

Total Credit Hours: 21

DSE-Discipline Specific Elective

SEC-Skill Enhancement Course

- **Practical training of 72 hours (Non credit based) have been included in course curriculum of B.Sc Non Medical: : Students have to complete their practical training in 3 year degree tenure and have to be evaluated on the basis of final submission of report and presentation before the Departmental Committee .**

Course Scheme Summary

Semester	L	T	P	Contact hrs/wk	Credits	CR	AECC	SEC	DSE
1	**15**	**1**	**5**	**28**	**21**	**18**	**3**		
2	**15**	**1**	**5**	**28**	**21**	**18**	**3**		
3	**18**	**1**	**4**	**27**	**23**	**18**	**3**	**2**	
4	**18**	**1**	**4**	**27**	**23**	**18**	**3**	**2**	
5	**18**	**1**	**4**	**27**	**23**		**3**	**2**	**18**
6	**17**	**1**	**5**	**28**	**23**			**4**	**18**
Total	**101**	**6**	**27**	**165**	**134**	**72**	**15**	**10**	**36**

SCHEME &SYLLABUS
of
Physics
for
B.Sc Non-Medical

3 year programme

CORE COURSES

(Semester I-IV)

SEMESTER I

Semester	**I**
Course Code	**PHY101**
Course Title	**Mechanics**
Type of course	(Core)Theory
L T P	4:0:0
Credits	4
Course prerequisite	10+2 with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Enhance the knowledge of students in mechanics. 2. Impart the knowledge of Carstein coordinates, central forces, rotational system.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1 Explain the concept of Co–ordinate systems and frame of reference. CO2 Understand the concept of central force &Central Force Motion. CO3 Illustrate the concept of rotational dynamics, elasticity & relativity.

UNIT-I

Co–ordinate systems and Frame of references :Cartesian and spherical polar co–ordinate systems, area, volume, velocity and Acceleration in these systems; frame of reference, Galilean transformation, Galilean Invariance of space & time intervals; Newton's laws of motion; law of conservation of linearmomentum& energy; Inertial and non-inertial frames and fictitious forces;Uniformly rotating frame; Laws of physics in rotating coordinate systems; Centrifugal force; Coriolis force and its applications

UNIT-II

Central forces and Central Force Motion: Conservative and non-conservative forces; Potential Energy; Force as gradient of potential energy;Newton's Law of Gravitation, two body problem and concept of reduced mass; Motion of a body under central force; Differential equation of orbit; Kepler's laws and their derivation; Satellite in circular orbit and applications;Geosynchronous orbits; Weightlessness; Basic idea of global positioning system,Motion of rockets.

UNIT-III

Rotational dynamics and Elasticity: Angular momentum of a particle and system of particles,Principle of conservation of angular momentum, Rotation about a fixed axis,Torque, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. **Elasticity:**Hooke's law, Stress-strain diagram, 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, Torsional pendulum, Determination of Rigidity modulus and moment of inertia, q, η and σby Searles method.

UNIT-IV

Special Theory of Relativity: Michelson-Morley experiment and its outcome, Postulates of special theory of relativity, Lorentz transformations, Simultaneity and order of events, Length contraction, Time dilation and its experimental verification, Relativistic transformation of velocity, Relativistic addition of velocities, Variation of mass with velocity, Mass-energy equivalence, Relativistic Doppler Effect, Relativistic kinematics, Transformation of energy and momentum.

Text and Reference Books:

S. No.	Title	Author(s)	Publisher
1	Mechanics Berkeley Physics course	Charles Kittel, et. Al.	2007, Tata McGrawHill
2	Engineering Mechanics	Basudeb Bhattacharya	2nd edn., 2015, Oxford University Press
3	An introduction to mechanics	D. Kleppner, R.J. Kolenkow	New Delhi: McGrawHill, 1973.
4	Analytical Mechanics	G.R. Fowles and G.L. Cassiday	New Delhi: Cengage Learning, 2005.

Semester	**I**
Course Code	**PHY103**
Course Title	**Mechanics (Practical)**
Type of course	(Core) Practical
L T P	0:0:4
Credits	2
Course prerequisite	10+2 physics with a core subject
Course Objective	**The aim of this course is to** 1. Impart practical knowledge to the students and provide them with exposure of basic measuring instruments in mechanics. 2.Impart practical knowledge of the working principle of instruments
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1.Determine length, height, moment of inertia, young's modulus, modulus of rigidity, elastic constants of various system by using different apparatus. CO2.Verify the Newton's 2nd law. CO3.Demonstrate the experimental techniques for different pendulums.

*** Note:** Students has to perform any of the 12-14 experiments from the given list**.**

1. To determine the Moment of Inertia of a Flywheel.
2. To find torque of a flywheel.
3. To determine the angular acceleration of flywheel.
4. To find the acceleration and distance of the cart in the given interval of time (Newton's 2nd law).
5. To find the Time of flight, Horizontal range and maximum height of a projectile for different velocity, angle of projection, cannon height and environment.
6. To determine g by Kater's Pendulum.
7. To determine g and velocity for a freely falling body using Digital Timing Technique.
8. To find the radius of gyration of objects of different geometrical shapes but of same mass by noting the time period of oscillation.
9. To determine g by Bar Pendulum.
10. To understand the torsional oscillation of pendulum in different liquid and determine the rigidity modulus of the suspension wire using torsion pendulum.
11. To study the Motion of a spring and calculate (a) Spring Constant (b) Value of g.
12. To determine the Elastic Constants of a Wire by Searle's method.
13. To determine the Young's Modulus of a Wire by Optical Lever Method.
14. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
15. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
16. To determine the Height of a Building using a Sextant.

Text and Reference Books:

S. No.	Title	Author(s)	Publisher
1	Practical Physics	C. L. Arora	S. Chand
2	Advanced Practical Physics for students	B.L.Flint and H.T.Worsnop	1971, Asia Publishing House
3	Engineering Practical Physics	S.Panigrahi&B.Mallick	Cengage Learning India Pvt. Ltd. 2015
4.	A Text Book of Practical Physics	Indu Prakash and Ramakrishna	11th Edition, 2011, Kitab Mahal, New Delhi.
5.	Advanced level Physics Practicals	Michael Nelson and Jon M. Ogborn,	4th Edition, reprinted 1985, Heinemann Educational

			Publishers.

SEMESTER IInd

Semester	**II**
Course Code	**PHY102**
Course Title	**Electricity and Magnetism**
Type of course	(Core)Theory
L T P	4: 0:0
Credits	4
Course prerequisite	10+2 with physics as core subject.
Course Objective (CO)	**The aim of this course is to** 1. Enhance the knowledge of students in Electricity and Magnetism. 2. Ehance understanding of Electromagnetic applications.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1understand the vector calculus and vector algebra and its applications in electricity and magnetism. CO2 Learn how to analyze various problems in electrostatics& magnetostatics with mathematical methods. CO2 analyze various problems in electromagnetism with mathematical methods and able to solve Maxwell equations.

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.

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

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

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:

Sr No.	Title	Author(s)	Publisher
1	Introduction to Electrodynamics	D J Griffith	Prentice-Hall of India
2	Physics Vol 2	Halliday and Resnik	Tata McGraw-Hill
3	Electricity and Magnetism	A S Mahajan and A ARangwala	Tata McGraw-Hill
4	Berkeley Physics Course, Vol. 1, Mechanics	E M Purcell, Ed	Tata McGraw-Hill
5	Electricity and Magnetism	Edward M. Purcell	1986, McGraw-Hill Education
6	Electricity and Magnetism	J.H. Fewkes& J. Yarwood	Vol. I, 1991, Oxford Univ. Press.

Semester	**II**
Course Code	**PHY104**
Course Title	**Electricity and Magnetism (Practical)**
Type of course	(Core)Practical
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with physics as core subject
Course Objective	**The aim of this course is to** 1. Impart practical knowledge to the students and provide them with practical exposure of electricity and magnetism. 2.Impart practically the knowledge of role of electric instruments in working of applicances.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Determine resistance, voltages, current, fuses, capacitances, field strength by using multimeter, galvanometer, de-sauty bridge, carey foster bridge &solenoid. CO2: To determine characteristic, resonant frequency& quality factor of RC, LCR (series, parallel) circuits. CO3: To determine magnetism by using different apparatus

*** Note:** Students has to perform any of the 12-14 experiments from the given list.

1. To use a Multimeter for measuring (a) Resistances,(b) AC and DC Voltages (c) DC Current (d) Checking electrical fuses.
2. Measurement of charge and current sensitivity.
3. Measurement of CDR.
4. Determine a high resistance by Leakage Method.
5. To determine the reduction factor of the given tangent galvanometer (*K*).
6. To find out the horizontal component of earth's magnetic field (B_h).
7. To compare capacitances using De'Sauty's bridge.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To find the temperature coefficient of resistance of a given coil.
10. To determine Self Inductance of a Coil by Rayleigh's Method.
11. To determine the self inductance of the coil (L) using Anderson's bridge.
12. To calculate the value of inductive reactance (X_L) of the coil at a particular frequency.
13. To study the Characteristics of a Series RC Circuit.
14. To study the series LCR circuit and determine its: (a) Resonant frequency, (b) Impedance at resonance (c) Quality factor Q (d) Band width
15. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
16. To study the variation of magnetic field with distance along the axis of a circular coil carrying current.
17. To determine the volume magnetic susceptibility of Manganese sulphate solution at different concentrations.
18. To determine the magnetic dipole moment (*m*) of a bar magnet and horizontal intensity (B_H) of earth's magnetic field using a deflection magnetometer.
19. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)

Text and Reference Books:

Sr No.	Title	Author(s)	Publisher
1	Practical Physics	C. L. Arora	S. Chand
2	Advanced Practical Physics for students	B.L.Flint&H.T.Worsnop	1971, Asia Publishing House.
3	A Text Book of Practical	Indu Prakash and Ramakrishna	11th Edition, 2011, Kitab Mahal,

	Physics		New Delhi.
4	Engineering Practical Physics	S.Panigrahi&B.Mallick	2015, Cengage Learning India Pvt. Ltd.
5	Advanced level Physics Practicals	Michael Nelson and Jon M. Ogborn	4th Edition, reprinted 1985, Heinemann Educational Publishers

SEMESTER IIIrd

Semester	**III**
Course Code	**PHY201**
Course Title	(Core) **Thermal Physics**
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	BSc. Ist with physics as core subject.
Course Objective	**The aim of this course is to** 1. Impartttheoretical knowledge to the students in thermal, statistical and atomic physics. 2. Impart the understanding of basic thermodynamics.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Have a basic knowledge of the thermodynamically system and potentials. CO2: Understand the physics of kinetic theory of gases. CO3: Solve statistical mechanics problems for simple non-interacting systems.

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.

UNIT-II

Entropy: Second law & Entropy, Carnot's cycle & theorem, changes in reversible & irreversible processes, Entropy-temperature diagrams**,**Third law of thermodynamics, Unattainability of absolute zero, Gibbs, Helmholtz and Internal Energy functions,Maxwell's equations, Clausius- Clapeyron equation, Expression for (CP – CV), CP/CV, TdS equations**.**

UNIT-III

Thermodynamic Potentials: Enthalpy, Joule Thomson effect, Use of Joule Thomson effect in liquefaction of gases,Low temperatures: Production and measurement of very low temperatures, adiabatic demagnetization, Phase transitions of first and second orders, phase diagrams of Helium Gibbs phase and its applications.

UNIT –IV

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 DensityDerivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, StefanBoltzmann Lawand Wien's displacement law from Planck's law

Text and reference books:

S.No	Title	Author	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
5	Thermal Physics	A. Kumar and S.P. Taneja	2014, R. chand Publications.

Semester	**III**
Course Code	**PHY203**
Course Title	**Thermal Physics (Practical)**
Type of course	(Core) Practical
L T P	0:0: 4
Credits	2
Course prerequisite	BSc. Ist with physics as core subject
Course Objective	**The aim of this course is to** 1. Impartpractical knowledge to the students and provide them with exposure of thermodynamics& and statistical mechanics. 2. Enhance the practical knowledge related to concept of heat, energy.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: To interpret various experiments using Mechanical Equivalent of heat. CO2: To devise various experiments using the concept of Thermal conductivity. CO3: To illustrate various experiments using the theory of probability &expansion of gases.

*** Note:** Students has to perform any of the 12-14 experiments from given list.

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 compare heat transfer between different material surface and the black body surface by radiation.
4. To find the emissivity of different material surface.
5. To determine Stefan's Constant of material.
6. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
7. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
8. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
9. To find the co-efficient of thermal conductivity of bad conductor by using Lee's method.
10. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
11. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
12. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
13. To verify certain laws of probability.
14. To verify laws of probability by throwing one, two or 10 coins.
15. To determine the co-efficient of increase of volume of air at constant pressure.
16. To determine the co-efficient of increase of pressure of air at constant volume.

Text and reference books:

S.No	Title	Author	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 IVth

Semester	**IV**
Course Code	**PHY202**
Course Title	**Waves and Optics**
Type of course	(Core)Theory
L T P	4: 0:0
Credits	4
Course prerequisite	BSc. Ist with physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Enhance the knowledge of students in wave and optics. 2. Understand the working concepts of wave motion, interference, polarization, diffraction.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: To explain various concepts regarding waves motion & simple harmonic motion CO2: Understand the concepts of wave optics, different optical instruments. CO3: Analyze the basic difference between interference, diffraction &polarization. .

UNIT-I

Wave: Types of Waves, Characteristics of Wave Motion, Differential Equation of Wave Motion, Equation of a Progressive Simple Harmonic Waves, Energy in Progressive waves, Velocities of Wave motion – Particle, Wave and Group Velocities, Relation between Particle Velocity and Wave Velocity,Transverse waves on a string, Travelling and standing waves on a string, Normal Modes of a string, Reflection and Transmission of Waves on a string at a Boundary, Reflection and Transmission Coefficients – Amplitude and Energy, Stationary Waves and Waves on a string of fixed length, Nodes and Anti-nodes, Energy of a Vibrating String.

UNIT-II

Simple harmonic motion: Hooke's law, Simple harmonic motion, Equation of Simple harmonic motion, Frequency, Amplitude, Displacement, Velocity, Acceleration, and phase difference of SHM, Energy of a simple harmonic oscillator, Compound pendulum, Torsional pendulum, Simple harmonic oscillations in electrical system, Principle of Superposition Harmonic Oscillations, Superposition of Two Harmonic Motions of Same Frequency, Beats, Lissajous Figures and its applications, Anharmonic Oscillations.

Sound**:** 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

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), Determinationof wavelength, Wavelength difference, Refractive index and Visibility of fringes.

UNIT-IV

Diffraction and Polarisation: Fraunhofer diffraction: Single slit; double slit. Multiple slits & Diffraction grating, Fresnel Diffraction: Half-period zones. Zone plate, Fresnel Diffraction pattern of 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.Polarization by transmission and reflection, Malus Law, Brewster's Law, Polarization by refraction, Theory of double refraction, Quarter wave and half wave plates, Production and detection of polarized light.

Text and Reference Books:

S.No	Title	Author	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

Semester	**IV**
Course Code	**PHY204**
Course Title	**Waves and Optics (Practical)**
Type of course	(Core)Practical
L T P	0:0:4
Credits	2
Course prerequisite	BSc. Ist with physics as core subject.
Course Objective	**The aim of this course is to** 1. Impart practical knowledge among the students and provides them with exposure on wave and optics related experiments. 2.Builds strong practical understanding of optical phenomenons.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: infer refractive index, Cauchy constant of prism using Sodium Light, Mercury Light. CO2: Determine the wavelength, grating element, of sodium light, laser light using Fresnel biprism, Resolving Power Plane diffraction grating, Newton's Rings, Michelson interferometer, Diffraction of Single Slit. CO3: Draw the inferences of Brewster's law, specific rotation of cane sugar and motion of coupled oscillators..

*** Note:** Students has to perform any of the 12-14 experimentsfrom given list.

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
3. To determine the value of Cauchy Constants of a material of a prism.
4. To determine the Resolving Power of a Prism.
5. To determine wavelength of sodium light using Fresnel Biprism.
6. To determine wavelength of sodium light using Newton's Rings.
7. To determine the refractive index of a thin glass plate.
8. To determine the wavelength of a laser using the Michelson interferometer.
9. To determine the wavelength of Laser light using Diffraction of Single Slit.
10. To determine the grating element of Laser light using Diffraction of Single Slit.
11. To determine the Resolving Power of a Plane Diffraction Grating.
12. To verify the Brewster's law and to find the Brewster's angle.
13. To measure the specific rotation of cane sugar using Polarimeter.
14. To investigate the motion of coupled oscillators.
15. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda 2 - T$ Law.
16. To study Lissajous Figur

Text and Reference Books:

S.No	Title	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

DISCIPLINE ELECTIVE COURSES (Semester V - VI)

SEMESTER

Vth

Semester	**V**
Course Code	**PHY301**
Course Title	**Digital, analog circuits and instrumentation**
Type of course	(DSE) Theory
L T P	4: 0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** **1.** Impart knowledge to the students about digital electronics and analog circuits and instrumentations. 2. Understanding of working principle of electrical devices.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1:Gain knowledge about the concepts of digital circuits. CO2: Understand the physics of semiconductor devices and amplifiers including OPAMPS. CO3:Infer the working of different electrical-electronic instruments.

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 andCC Configurations. Active, Cutoff and Saturation Regions. Current gains α and β, Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point, Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.

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, IC 555 Pin diagram and its application as Astable& Monostable Multivibrator.

Text and reference books:

S.No	Title	Author	Publisher
1	Integrated electronics	J. Millman and c.c. halkias, 1991	Tata mc-graw hill.
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.

Semester	**V**
Course Code	**PHY303**
Course Title	**Digital , analog circuits and instrumentation (Practical)**
Type of course	(DSE) Practical
L T P	0:0: 4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** **1.**Impart practical knowledge to the students about digital electronics and analog circuits and instrumentations. 2. Build the strong practical knowledge abouts electrical instruments.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Analyze, design and implement combinational logic circuits. CO2: Knowledge of operational working of semiconductor devices. CO3: Analyze, design and implement sequential logic circuits.

*** Note:** Students has to perform any of the 12-14 experiments from the given list.

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To test a Diode and Transistor using a Multimeter.
3. To verify and design AND, OR, NOT and XOR gates using NAND gates.
4. To design a combinational logic system for a specified Truth Table.
5. To minimize a given logic circuit.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. Half adder, Full adder and 4-bit Binary Adder.
8. Adder-Subtractor using Full Adder I.C.
9. To design an astable multivibrator of given specifications using 555 Timer.
10. To design a monostable multivibrator of given specifications using 555 Timer.
11. To study I-V characteristics of PN diode, Zener and Light emitting diode.
12. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
13. To study (a) Half-wave Rectifier (b) Full-wave Bridge Rectifier and investigate the effect of C, L and π filters.
14. To study the characteristics of a Transistor in CE configuration.
15. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
16. To study the characteristics of a Bipolar Junction Transistor in CE, CB and CC configurations.
17. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
18. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
19. To design a non-inverting amplifier of given gain using Op-amp 741 and study it's Frequency Response.
20. To study a precision Differential Amplifier of given I/O specification using Op-amp.
21. To investigate the use of an op-amp as a Differentiator
22. To design a Wien Bridge Oscillator using an op-amp.

Text and reference books:

S.No	Title	Author	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.

Semester	**V**
Course Code	**PHY305**
Course Title	**Elements of Modern Physics**
Type of course	(DSE) Theory
L T P	4:0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Enhance the knowledge of students about the basic concept of quantum Mechanics and nuclear physics. 2. Understanding of microspic nature of wave functions.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Explain the basic concepts of quantum mechanics. CO2: Understand about Schrodinger equations & its application including non-relativistic particles, operators, and energy eigen value and eigen function in 1 dimensional. CO3: Interpret various potential barriers using Schrodinger equations & fundamental concepts of nuclear physics.

UNIT-I

Basic concept of Quantum mechanics: 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 and their spectra. Wave-particle duality, Heisenberg uncertainty principle, Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

UNIT-II

Matter waves and wave amplitude: 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, One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

UNIT-III

Atomic nucleus: 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, NZ graph, 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 with Uranium 235; Fusion and thermonuclear reactions.

Text and Reference Books:

S.No	Title	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.
4	Introduction to Quantum Mechanics	David J. Griffith	Pearson Education. 28, 2005
5	Quantum Mechanics: Theory & Applications,	A.K.Ghatak&S.Lokanathan	Macmillan, 2004.

Semester	**V**
Course Code	**PHY307**
Course Title	**Elements of Modern Physics (Practical)**
Type of course	(DSE) Practical
L T P	0:0:4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** 1. Impart practical knowledge of quantum mechanics and nuclear physics. 2. Enhance the understanding of functioning of of basic phenomenens,
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: determine botzmann constant, planck constant, work function of material using electronic devices. CO2: determine ionization potential of mercury, wavelength of H- atom, absorption lines of iodine vapour. CO3: Infer the photo electric effect, charge of electron, e/m value experimentally.

*** Note:** Students has to perform any of the 12 out of 14 experiments from the given list

1. To determine work function of material of filament of directly heated vacuum diode

2. To determine the thermionic work function of tungsten.

3. To determine value of Boltzmann constant using V-I characteristic of PN diode.

4. To determine value of Planck's constant using LEDs of at least 4 different colours.

5. Measurement of Planck's constant using black body radiation and photo-detector.
6. To determine the ionization potential of mercury.
7. To determine the wavelength of H-alpha emission line of Hydrogen atom.
8. To determine the absorption lines in the rotational spectrum of odineVapour.
9. To study the diffraction patterns of single and double slits using laser source source and measure its intensity variation using Photosensor and compare with incoherent source – Na light.
10. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
11. Study of excitations of a given atom by Franck Hertz set up.
12. To determine the value of e/m by magnetic focusing, bar magnet.
13. To setup the Millikan oil drop apparatus and determine the charge of an electron.
14. To determine charge to mass ratio of an electron by Thomson method.

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	Advanced practical physics for students	B.l. Flint &h.t.Worsnop	Asia publishing house, 1971.
2	Advanced level physics practicals	Michael nelson and jon m. Ogborn	Heinemann educational publishers4th edition, reprinted 1985

SEMESTER VIth

Semester	**VI**
Course Code	**PHY302**
Course Title	**Solid State Physics**
Type of course	(DSE) Theory
L T P	4:0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Enhance the knowledge of students in the field of solid state physics. 2. Learn basics of theories of crystal structure,magnetic, dielectric properties
Copurse Outcomes (CO)	**By the end of this course, students will be able to** CO1: Explain the detail concepts of crystal structure. CO2: Understand the physics of magnetic properties of matter & dielectric properties of materials. CO3: Illustrate the Kronig model, Hall effect & physics of superconductors..

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, 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	Title	Author	Publisher
1.	Introduction to solid state physics	Charles kittel, 8th ed., 2004,	Wiley indiapvt .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

Semester	**VI**
Course Code	**PHY304**
Course Title	**Solid State Physics (Practical)**
Type of course	(DSE) Practical
L T P	0:0: 4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** **1.**Impart practical knowledge to the students about solid state physics. 2. Impart practical knowledge of principle behind the working of instrument like PN junction etc.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Calculate the magnetic susceptibilty, coupling coefficient of crystal. CO2: measure dielectric constant of metals & refractive index of dielectric layer using SPR technique. CO3:Analyze PE, BH curve for magnetic materials, resistivity & Hall coefficient for semiconductor crystal.

*** Note:** Students has to perform any of the 12 out of 14 experiments from the given list.

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.
11. To study the reverse saturation current to a PN junction diode at various temperatures and to find the approximate value off energy gap.
12. To measure dielectric constant of a non-polar liquid and its applications.
13. To measure the thermal conductivity and thermal diffusivity of a conductor.
14. To study temperature coefficient of resistance of Cu.

Text and reference books:

S. no.	Title	Author	Publisher
1	Advanced practical physics for students	B.l. Flint and H.T Worsnop,	Asia publishing house1971
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,	Induprakash and ramakrishna	11th ed., 2011, kitab mahal, new delhi
4	Elements of solid state physics	J.p. Srivastava	2nd ed Prentice-Hall of India,2006

Semester	**VI**
Course Code	**PHY306**
Course Title	**Quantum Mechanics**
Type of course	(DSE) Theory
L T P	4:0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Introduce students to the basic of microscopic field in Physics. 2. Understand concept with the help of schrodinger equations.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: To develop fundamental knowledge of Schrodinger equation, operators, wavefunction. CO2: To correlate the mathematical analysis of harmonic oscillator CO3: To explain the Zeeman effects and atom in electric and magnetic field.

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

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

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 AntisymmetricWave 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/Title	Author	Publisher
1	Quantum Mechanics	Leonard I. Schiff, 3rdEdn. 2010,	Tata McGraw Hill
2	Quantum Mechanics	Leonard I. Schiff, 3rdEdn. 2010,	Tata McGraw Hill

Semester	**VI**
Course Code	**PHY308**
Course Title	**Quantum Mechanics (Practical)**
Type of course	(DSE) Theory
L T P	0:0:4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 2. Introduce students to the basic of microscopic field in Physics. 2. Understand concept with the help of schrodinger equations.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: develop practical knowledge of ESR, Zeeman Effect, Tunnelling. CO2: Understand practically the concept of photoelectric effect, planck constant CO3: Develop knowledge on ionization potential, absorption spectra., concept of electron

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.

4. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.

5. To determine the Planck's constant using LEDs of at least 4 different colours.

6. To determine the ionization potential of mercury.

7. To determine the absorption lines in the rotational spectrum of Iodine vapour.

8. To setup the Millikan oil drop apparatus and determine the charge of an electron.

Text and Reference Books:

.

S.No.	Name/Title	Author	Publisher
1	Quantum Mechanics	Leonard I. Schiff, 3rdEdn. 2010,	Tata McGraw Hill
2	Quantum Mechanics	Leonard I. Schiff, 3rdEdn. 2010,	Tata McGraw Hill

Semester	**VI**
Course Code	**PHY310**
Course Title	**Nuclear & Particle Physics**
Type of course	(DSE) Theory
L T P	4: 0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Impart theoretical knowledge to the students in the field of nuclear physics. 2.Enhances the knowledge of nuclear structure physics.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Understand general properties of nuclei & concept of nuclear models. CO2: classify the different types of radioactive decay & interaction of nuclear radiation with matter. CO3: Interpret the working principle of various particle accelerators.

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, 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, 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.

UNIT-IV

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem 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.	Title	Author	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

Semester	**VI**
Course Code	**PHY312**
Course Title	**Nuclear & Particle Physics (Practical)**
Type of course	(DSE) Practical
L T P	0:0:4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** 1. Impart practical aspects of nuclear Physics to the students. 2. Understanding the working of GM counter and how it works in detecting radioactive particles.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: draw plateau region, calculate dead time, study gaussian distribution, poisson distribution using GM Counter. CO2: determine absorption coefficient, source strength of beta source using GM Counter. CO3: detect the presence of gamma radiation using scintillation counter.

Note: Students has to do any of 12 experiments from the given list.

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 aluminum 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.
9. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
10. Study of counting statistics using background radiation using GM counter.
11. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
12. Study of absorption of beta particles in Aluminum using GM counter.
13. Detection of α particles using reference source & determining its half-life using spark counter.
14. Gamma spectrum of Gas Light mantle (Source of Thorium)
15. Study the background radiation levels using Radiation meter.

Text and reference books:

S. no.	Title	Author	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	Introductory nuclear Physics	Kenneth S. Krane .	Wiley (1978)

Semester	**VI**
Course Code	**PHY316**
Course Title	**Embedded System: Introduction to Microcontrollers**
Type of course	(DSE) Theory
L T P	4: 0:0
Credits	4
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** **1.** Enhance knowledge of the students in the field of microcontrollers. 2. Uses of the microcontrollers in electronics, electrical circuits.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Understand the concept of Embedded system CO2: Understand the concept of microcontroller apply on the systems CO3: Solve the programming of 8085 microcontroller unit.

UNIT-I

Embedded system introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers.

UNIT-II

8051 microcontroller: Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions. Introduction of I/O port programming, pin out diagram of8051 microcontroller, I/O port pins description and their functions, I/O port programming in 8051, (Using Assembly Language), I/O programming: Bit manipulation.

UNIT-III

Programming of 8051: 8051addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic & logic instructions, 8051 programming in C:- for time delay and I/O operations and manipulation, for arithmetic & logic operations, for ASCII and BCD conversions, Programming 8051 timers.

UNIT-IV

Programming Embedded Systems: Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging. Embedded system development environment, file types generated after cross compilation, disassembler/decompiler, simulator, emulator and debugging, embedded product.

Text and reference books:

S. no.	Title	Author	Publisher
1	Electronics: fundamentals and applications,	J.d. Ryder, 2004,	Prentice hall..
2	Microelectronic circuits,	M.h. Rashid, 2ndedn.,2011	Cengage learning.
3	Op-amps and linear integrated circuit,	R. A. Gayakwad, 4th edition, 2000,	Prentice hall.

Semester	**VI**
Course Code	**PHY318**
Course Title	**Embedded System: Introduction to Microcontrollers (practical)**
Type of course	(DSE) Practical
L T P	0:0: 4
Credits	2
Course prerequisite	BSc. Ist ,IInd year with Physics as core subject
Course Objective(CO)	**The aim of this course is to** 1. Impart practical knowledge to the students of microcontrollers, embedded system. 2. Impart practical knowledge of the working of microcontroller and how it is use in building other circuits.
Course Outcomes (CO)	**By the end of this course, students will be able to** CO1: Determine 4 ports of 8051 embedded system. CO2:Determine LED using TIMER application. CO3:Infer LED effect by using embedded system.

LIST OF EXPERIMENTS

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
4. Program to glow first four LED then next four using TIMER application.
5. Program to rotate the contents of the accumulator first right and then left.
6. Program to run a countdown from 9-0 in the seven segment LED display.
7. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.

Text and reference books:

S. no.	Title	Author	Publisher
1	Electronics: fundamentals and applications,	J.d. Ryder, 2004,	Prentice hall..
2	Microelectronic circuits,	M.h. Rashid, 2ndedn.,2011	Cengage learning.
3	Op-amps and linear integrated circuit,	R. A. Gayakwad, 4th edition, 2000,	Prentice hall.

SKILL ENHANCEMENT COURSES of Physics

(Semester III - VI)

Semester	**III**
Course Code	**PHY205**
Course Title	**Physics workshop skill**
Type of course	Skill Enhancement Courses
L T P	2 :0:0
Credits	2
Course prerequisite	B.Sc Ist year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** **1.**Enable the students to familiar and experience with various mechanical and electrical tools through hands-on. 2. Impart practical workshop knowledge of different measuring instruments.
Course outcome(CO)	**By the end of this course, students will be able to:** CO1: Explain the working of vernier calliper, screw gauge, sextant in measuring length, height, thickness, diameter etc. CO2: Understand the physics of various workshops (casting, foundry, welding etc) &their use in electrical circuits. CO3: Infer the concepts of gear system, levers, pulleys.

UNIT-I

Measuring units: Conversion to SI and CGS. Familiarization with meterscale, 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, and 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 withmotor axel. Lever mechanism, lifting of heavy weight using lever. Braking systems, pulleys.

Text and reference books:

S. No	Title	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	Elbsedn
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
5	New Engineering Technology	Lawrence Smyth/Liam Hennessy,	The Educational Company of Ireland

Semester	**IV**
Course Code	**PHY206**
Course Title	**Electrical circuits and network skills**
Type of course	Skill Enhancement Courses
L T P	2:0:0
Credits	2
Course prerequisite	B.Sc Ist year with Physics as core subject
Course Objective (CO)	**The aim of this course is to** 1. Enable the students to design and trouble shoots the electrical circuits, networks and appliances. 2. Learn about basic devics, their symbols, working of motors and wiring in circuits.
Course Outcome (CO)	**By the end of this course, students will be able to:** CO1: Acquire the basic knowledge of role of electricity inelectrical circuits. CO2: Understand the physics regarding electrical designs, symbols and electric motors. CO3: Interpret the different types of electrical wiring & electrical protection devices.

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 power components 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 anddelta 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.

Basic knowledge of legal aspects of Medical Records including Factories Act, Workmen Compensation Act & Consumer Protection Act. Procedures of Medical Auditing & its importance, Government Regulations & requirements

Text and Reference Books

S. No.	Author(s)	Title	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.
3	Performance and design of AC machines	M G Say	ELBS Edn.

Semester	**V**
Course code	**PHY309**
Course title	**Renewable and Energy Harvesting**
Type of course	Skill enhancement Course
LTP	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** **1.** Enhance knowledge of students about Renewable sources and Energy Harvesting. 2. Enhance knowledge how these renewable sources are used in different sectors.
Course outcome(CO)	**By the end of this course, students will be able to:** CO1: Explain renewable sources and fundamentals of energy harvesting. CO2 Understand the physics of geothermalenergy, thermal & hydro energy. CO3 Classify different tools for energy harvesting.

UNIT-I

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, theirlimitation, 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.	Title	Author	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	Photovoltaic	J.Balfour, M.Shaw and S. Jarosek	Lawrence J Goodrich (USA).

Semester	**VI**
Course Code	**PHY314**
Course Title	**Radiology and Safety**
Type of course	Skill enhancement Course
L T P	2:0:0
Credits	2
Course prerequisite	B.ScIInd year with Physics as a core subject
Course Objective	**The aim of this course is to** **1.** Enable the students to enhance their knowledge of radiation physics & their safety procedure. 2. Understanding of radioactive nuclei.
Course outcome(CO)	**By the end of this course, students will be able to:** CO1:Explain the basics of atomic & nuclear physics. CO2: Understand about different types of radiation, its detection and measuring instruments. CO3: Classify the radiation safety measures. .

UNIT I:

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; 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 III

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, and limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management.

UNIT IV

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 Radiology	W.J. Meredith and J.B. Massey	John Wright and Sons, UK, 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.

SCHEME & SYLLABUS
of
CHEMISTRY
for
B.ScNonMedical&
B.Sc Medical
3 year programme

CORE COURSES

(Semester I-IV)

SEMESTER Ist

Semester	**I**
Course Code	**CHM 101**
Course Title	**Atomic Structures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons**
Type of course	CORE (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** 1. Enhance the knowledge of students in Chemical bonding atomic / molecular structure. 2. Impart basic knowledge of concepts of organic chemistry. 3. To visualizing the organic molecules in a three-dimensional space.
Course outcome	**By the end of the course, the students will be able to:** CO1 Solve the conceptual questions using the knowledge gained from quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy. and electron affinity of elements. CO2 Draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams. CO3 Able to explains significance of quantum numbers , de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problems. CO4 Understand and explain the different nature and behavior of organic compounds and able to analyse and evaluate fundamental concepts of stereochemistry

Unit-I

Atomic Structure: Review of: Bohr's theory and its limitations, dual behavior ofmatter 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, Wurtzreaction,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

Semester	**I**
Course Code	**CHM 103**
Course Title	**Atomic Structures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons (Practical)**
Type of course	CORE (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** 1Impart practical knowledge to the students about the separation of organic molecules 2.To study and perform experiments based upon estimation of inorganic salt and metal ions.
Course outcome	**By the end of the course, students will be able to:** CO1 Estimate and identify the various ions in stock solutions. CO2 Detection of elements (N, S and halogens) in organic compounds, Detection of functional groups CO3 Identify amino acid & sugars through chromatographic methods

Volumetric Analysis

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

Organic Chemistry

Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

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
Identify and separate the sugars present in the given mixture by paper chromatography.
Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC).
*_Perform any four experiments from each section_

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

SEMESTER IInd

Semester	**II**
Course Code	**CHM 102**
Course Title	**Chemical Energetic Equilibria and Functional Group Organic Chemistry – I**
Type of course	CORE (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** 1.Enhance the knowledge of students regarding Physical concepts of chemistry like Chemical Energetic, Chemical Equilibrium. 2. Provide coherent knowledge of general organic chemistry of aromatic systems and functional groups.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire the knowledge of thermodynamic property of any system , Chemical & Ionic equilibria of various systems. CO2 Apply the concepts of concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt, pH and electrolytes. CO3 Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups. CO4 Use the synthetic chemistry for functional group transformations & to propose plausible mechanisms for any relevant reaction.

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

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 1^o, 2^o and 3^o 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.$KMnO_4$, acidic dichromate, conc. HNO_3). 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-PondorffVerley 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

Semester	**II**
Course Code	**CHM 104**
Course Title	**Chemical Energetic Equilibria and Functional Group organic Chemistry-I (Practical)**
Type of course	Core (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** 1.Provide practical knowledge about the preparation of organic compounds. 2. To perform various experiments based on Thermo-chemistry and Ionic equilibrium.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire basic concepts of thermochemistry,Analyse thermodynamic parameters of solutions and salt mixtures. CO2 Find out the acidity, Basicity and pKa Value on pH meter. CO3 Accurately evaluate separation, purifications techniques, of organic compounds.

Section A: Physical Chemistry

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.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter.
2. Preparation of buffer solutions: Sodium acetate-acetic acid; Ammonium chloride-ammonium hydroxide
3. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

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.

Bromination of Phenol/Aniline ; Benzoylation of amines/phenols

Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone; Acetylation of amines/phenols

*<u>*Perform any four experiments from each section*</u>

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

SEMESTER IIIrd

Semester	**III**
Course Code	**CHM 201**
Course Title	**Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II**
Type of course	Core (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** 1. Impart knowledge to the students about basic of solution chemistry, phase equilibia, 2. Impart knowledge to the students about Electrochemistry. 3. To provide coherent knowledge of organic chemistry and natural polymers.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire coherent knowledge of solutions, phase equilibrium and conductance CO2 Learn the working of electrochemical cells, EMF & pH determination. CO3 Understand structure and bonding in carboxylic acids and amine derivatives&Use the synthetic chemistry for functional group transformations. CO4 Identify &Analyse structural components, configuration of amino acids, proteins and Carbohydrates

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

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.

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. pH determination using hydrogen electrode and quinhydrone electrode.

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 (openchain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in mono-saccharides.

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

Semester	**III**
Course Code	**CHM 203**
Course Title	**Solutions, Phase equilibria, Cond & Electrochemistry, Funct. Grp. Organic Chemistry-II (Practical)**
Type of course	Core (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc. 1st with chemistry as core subject
Course Objective	**The aim of this course is to** 1. Provide practical knowledge about conductometry, potentiometry. 2. Perform qualitative organic analysis.
Course outcome	**By the end of the course, students will be able to:** CO1demonstrate and calculate various parameters ofdistribution& phase equilibria CO2Calculate molar and normal solution of various concentrations. CO3perform and evaluate outcomes of conductometric & potentiometric titrations. CO4Study qualitative Organic Analysis & biochemical analysis of amino acids & carbohydrates.

Section A: Physical Chemistry

Distribution:

1. Study of the equilibrium of one of the following reactions by the distribution method:
2. $I_2(aq) + I^-(aq)$ $I_3^-(aq)$ $Cu^{2+}(aq) + xNH_2(aq)$ $[Cu(NH_3)_x]^{2+}$
3. Distribution of acetic/ benzoic acid between water and chloroform or cyclohexane.
4. To find EMF of the cell. To calculate the Gibbs free energy change of the cell reaction.
5. To calculate the equilibrium constant.

Phase equilibria

1. Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.
2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. 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

1. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
2. Perform the following conductometric titrations: Strong acid vs. strong base ; Weak acid vs. strong base

Potentiometry

1. Perform the following potentiometric titrations:

Strong acid vs. strong base;
Weak acid vs. strong base;
Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

1. Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a non reducing sugar.
7. Organic and inorganic synthesis

*<u>*Perform any four experiments from each section*</u>

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,
03	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
04	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company Limited.

SEMESTER IVth

Semester	**IV**
Course Code	**CHM 202**
Course Title	**Transition Metal & Coordination Chemistry, States of Matter and Chemical Kinetics**
Type of course	CORE (Theory)
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** 1. Impart knowledge to the students about basic of transition elements 2. Provide knowledge of bonding of transition elements. 3. Impart knowledge of states of matter and chemical kinetics.
Course Outcome	**By the end of the course, the students will be able to:** CO1 Understand the terms, ligand, and denticity of ligands, chelate, coordination number and use standard rules to name coordination compounds. CO2 Explain the meaning of the terms Δo., Δt, pairing energy, CFSE, high spin and low spin and magnetic properties and colour of complexes on basis of Crystal Field Theory CO3 Derive mathematical expressions for different properties of gas, liquid and solids and understand their physical significance. CO4 Have understanding of rate law and rate of reaction, theories of reaction rates and catalysts

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.

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. Critical phenomena, critical constants and their calculation from van der Waals equation.

Unit-III

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

Semester	**IV**
Course Code	**CHM 204**
Course Title	**Transition Metal & Coordination Chemistry, States of Matter and Chemical Kinetics (Practical)**
Type of course	Core (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** 1.Impart practical knowledge to the students about semi micro qualitative analysis. 2. To study practically physical properties of solutions.
Course Outcome	**By the end of the course, students will be able to:** CO1Analyse and estimate Qualitative analysis of inorganic cations & anions. CO2Calculate viscosity and surface tension of different liquids and solutions. CO3 Understand and apply gravimetric analysis and complexometric titrations. CO4 Derive mathematical expressions of chemical kinetics methods.

Section A: Inorganic Chemistry

1. **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:
2. 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^+
3. 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)

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

Section B: Physical Chemistry

Surface tension measurement (use of organic solvents excluded).

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

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

Viscosity measurement (use of organic solvents excluded).

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

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

Chemical Kinetics

Study the kinetics of the following reactions.

Initial rate method: Iodide-persulphate reaction

Integrated rate method:

Acid hydrolysis of methyl acetate with hydrochloric acid.

Saponification of ethyl acetate.

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

*<u>*Perform any four experiments from each section*</u>*

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,

DISCIPLINE ELECTIVE COURSES (Semester V - VI)

SEMESTER

V^th

Semester	**V**
Course Code	**CHM 301**
Course Title	**Molecules of Life**
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** 1. Impart coherent knowledge to the students about biomolecules 2. To study various structure, properties of biomacromolecules.
Course outcome	**On completion of this course, the students will be able to:** CO1 Understand and demonstrate how structure of biomolecules determines their reactivity and biological functions. CO2 Gain insight into concepts of heredity through the study of genetic code, replication, transcription and translation. CO3 Demonstrate understanding of metabolic pathways, their inter-relationship, regulation and energy production from biochemical processes.

Unit I

Carbohydrates: Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Amino Acids, Peptides and Proteins: Classification *of Amino Acids,* Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins.

Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C–terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis.

Unit -II

Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition(Competitive and Non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group,-NH2 group, double bond and aromatic ring,

Unit – III

Nucleic Acids: Components of nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides **(nomenclature**), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (**types of RNA**), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Lipids Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Unit IV

Concept of Energy in Biosystems: Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Lehninger's Principles of Biochemistry 7th Ed.,	Nelson, D. L. & Cox, M. M.	W. H. Freeman.
2.	Biochemistry, 2002	Berg, J.M., Tymoczko, J.L. &Stryer, L.	W.H. Freeman,
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.	Organic Chemistry (Vol. I & II),	I.L. Finar	E.L.B.S.
6.	Inorganic Chemistry	G.L. Miessler& Donald A. Tarr	Pearson Publication.
7.	Organic Chemistry,	R.T. Morrison & R.N. Boyd	Prentice Hall.
8.	A Guide Book to Mechanism in Organic Chemistry	Peter Sykes:	Orient Longman.

Semester	**V**
Course Code	**CHM 303**
Course Title	**Molecule of life (Practical)**
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** 1.Impart practical knowledge to the biochemical analysis. 2. To perform extraction and biomolecules.
Course outcome	**On completion of this course, the students will be able to:** CO1 Identify and carry out qualitative &quantitative analysis of biomolecules in stock solutions. CO2Analyze biochemical analysis of proteins, amino acids and carbohydrates.

1. Separation of amino acids by paper chromatography
2. To determine the concentration of glycine solution by formylation method.
3. Estimation of glucose by Fehling's solution.
4. Estimation of proteins by Lowry's method.
5. Determination of the isoelectric pH of a protein.
6. Study of titration curve of glycine
7. Action of salivary amylase on starch
8. Effect of temperature on the action of salivary amylase on starch.
9. To determine the saponification value of an oil/fat.
10. To determine the iodine value of an oil/fat
11. Differentiate between a reducing/ non reducing sugar.
12. Extraction of DNA from onion/cauliflower
13. To synthesise aspirin by acetylation of salicylic acid and compare it with theingredient of an aspirin tablet by TLC.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Textbook of Practical Organic Chemistry,	Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R.	ELBS.
2	Comprehensive Practical OrganicChemistry,	Ahluwalia, V.K. & Aggarwal, R.	Universities Press.
3	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
4	(2012), Biochemical Tests: Principles and Protocols.	Kumar, A.; Garg, S.; Garg, N.	Viva Books.

Semester	**V**
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** 1. Impart coherent knowledge to the students about organometallic chemistry. 2. To study polynuclear hydrocarbons. 3. To impart basic knowledge of organic spectroscopy.
Course outcome	**On completion of this course, the students will be able to:** CO1Apply 18-electron rule to rationalize the stability of organomettalic compounds CO2 Identify important structural features of the of Zeise's salt, metal alkyls tetrameric methyl lithium and dimeric trialkyl aluminium and explain the concept of multicenter bonding in these compounds CO3 Diagrammatically explain the working of the sodium-potassium pump in organisms and sources and consequences of excess and deficiency of trace elements CO4Analyse and elaborate structure & properties of polynuclear hydrocarbons CO5 Gain insight into the basic principles of UV, IR spectroscopic techniques & Use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds.

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, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

UnitII

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 III

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-hetero molecules)

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 (5^{th} 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.

Semester	**V**
Course Code	**CHM 307**
Course Title	**Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (Practical)**
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** 1. Impart practical knowledge to the students about organometallic chemistry 2. Perform organic qualitative analysis.
Course outcome	**On completion of this course, the students will be able to:** CO1 Interpret the structures of various complexes and understand their properties. CO2 Impart knowledge about handling the spectrophotometer and carry out qualitative &quantitative analysis CO3 Employ spectroscopy for characterization of metal complexes and organic compounds

Section A: Inorganic Chemistry

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+}

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

potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$

Section B: Organic Chemistry

Verification of Lambert-Beer's law and determination of concentration of a coloured species (CuSO4, KMnO4, CoCl2, CoSO4)

Identification of simple organic compounds by IR spectroscopy(Spectra to be provided).

Determination of a mixture of cobalt and nickel (UV-visible spectroscopy).

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 Chemistry	Ayodha Singh	Campus Books 2002
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,

Semester	**V**
Course Code	**CHM 309**
Course Title	**Industrial Chemicals 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** **1.**Make students aware about the concepts of different gases and their industrial production, uses, storage and hazards. 2. Manufacturing, applications, analysis and hazards of the Inorganic Chemicals, Air and Water pollution. 3. Control measures for Air and Water Pollutants, Catalyst and Biocatalyst, Energy and Environment.
Course outcome	**By the end of this course students will be able to understand:** CO1 Understand the vital role played by chemistry in industry. CO2 Give solution based on chemical knowledge in the field of various industries such as manufacturing processes, handling and storage of inorganic chemicals & hazardous effects of the inorganic chemicals. CO3 Composition of air, various air pollutants, effects and control measures of air pollutants. CO4 Different sources of water, water quality parameters, impacts of water pollution, water treatment. CO5 Different industrial effluents and their treatment methods. CO6 Different sources of energy & generation of nuclear waste and its disposal.

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 the following 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.

Biocatalysis Introduction 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	(2010), Environmental Pollution Analysis,	Khopkar, S.M.,	New Age International Publisher.
4	2003),Industrial Inorganic Chemistry,	Buchel, K.H.; Moretto, H.H.; Woditsch, P.	Wiley-VCH.
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.

Semester	**V**
Course Code	**CHM 311**
Course Title	**Industrial chemicals and environment (Practical)**
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** 1. Impart practical knowledge to the students in Industrial processes. 2. To analyse environment pollutants .
Course outcome	**By the end of this course students will be able to:** CO1 Identify and analyse various water quality parameters CO2Analyse quantitively air, water pollutants. CO3 Estimate bioindicators of pollution through titrimetrically and spectrophotometrically.

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	(2008),A Laboratory Manual for Environmental Chemistry,	Gopalan, R.; Anand, A.; Sugumar R.W.	I. K. International.
2	(2010), Environmental Pollution Analysis,	Khopkar, S.M.,	New Age International Publisher.
3	(1980),Experiments in Environmental Chemistry: A Laboratory Manual, Vol.4,	Vowles, P.D.; Connell, D.W.	Pergamon Series in Environmental Science.
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	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.

SEMESTER VIth

Semester	**VI**
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** 1.Impart detailed knowledge of Main group elements. 2. Study of industrial important processes based upon main group chemistry.
Course Outcome	**By the end of the course, the students will be able to:** CO1 Learn the fundamental principles of metallurgy and understand the importance of recovery of byproducts during extraction. CO2 Understand the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the periodic table. CO3 Understand structure & properties, role of inorganic polymers. CO4 Elaborate different acid and base reactions & covalent and ionic bonding using Lewis dot structure.

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

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.

Unit IV

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	J.E. Huheey	Harper Inter science

	Structure and Reactivity		
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,
8	(2014),Inorganic Chemistry, 5th Edition,	Miessler, G.L.; Fischer P.J.; Tarr, D. A.	Pearson.

Semester	**VI**
Course Code	**CHM 308**
Course Title	**Chemistry of Main Group Element, Theories of Acids and Bases (Practical)**
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** 1. Impart practical knowledge of iodometric, complexometric analysis. 2. To perform gravimetric titration used for analysis of Main group elements.
Course Outcome	**By the end of the course, the students will be able to:** CO1 Carry out iodometric/iodimetric analysis. CO2 Perform and estimate constituent ions through complexometric titrations & gravimetrically CO3 Handle and prepare some industrially significant complex salt

(A) Iodo / Iodimetric Titrations

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. Iodimetric estimation of ascorbic acid in fruit juices.
5. Estimation of iodine in iodized salts.

(B) Complexometric titrations using disodium salt of EDTA

(i) Estimation of Mg2+,Zn2+

(ii) Estimation of Ca2+ by substitution method

(C) Gravimetric Analysis

1. Gravimetric estimation of sulphate as barium sulphate.
2. Gravimetric estimation of aluminium as oximato complex

(D) Inorganic preparations

1. Preparation of the following :

(i) Cuprous Chloride, Cu2Cl2

(ii) Aluminium potassium sulphate KAl(SO4)2 .12H2O (potash alum) or Chromium potassium sulphate KCr(SO4)2.12H2O (chrome alum).

(iii)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	Advanced Practical Inorganic Chemistry	Ayodha Singh	Campus Books 2002
2	Vogel's Quantitative Chemical Analysis (6^{th} Edition, 7^{th} Edition),	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall

Semester	**VI**
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** 1 Impart theoretical knowledge to the students Green chemistry 2. Applications of green chemistry in organic synthesis.
Course Outcome	**By the end of the course, the students will be able to:** CO1 Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. CO2 Learn to design safer chemical ,products and processes that are less toxic, than current alternatives as well as safer design for accident prevention. CO3 Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems. CO4 Observe the current environmental issues 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:

Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis). 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. Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine). Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments. 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
7	Green Chemistry: An introductory text	Lancaster, M.	RSC publishing, 2nd Edition.

Semester	**VI**
Course Code	**CHM 312**
Course Title	**Green Chemistry (Practical)**
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** 1 Impart theoretical knowledge to the students Green chemistry 2. Applications of green chemistry in organic synthesis.
Course Outcome	**By the end of this course, students will be able to:** CO1 Apply twelve principles of green chemistry for synthesis and analysis. CO2 design safer chemical ,products and processes that are less toxic, than current alternatives CO3 Incorporate problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.

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
   (II) 1-propanol $\xrightarrow{H_2SO_4/\square}$ 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.

Semester	**VI**
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** 1.Make the student aware about concepts of analytical Chemistry various spectrophotometric, electroanalytical and themal methods of analysis 2. Make the students awareabout the importantseparation methods like solvent extraction and chromatography.
Course Outcome	**By the end of this course, students will be able to:** CO1 Understand basic principle of instrument of various spectrophotometric, electroanalytical and themal methods of analysis CO2Develop 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. CO4 Develop methods of analysis for different samples independently.

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	AllegnBecon, Latest edition
7	Instrumental Methods of Chemical	G.W.Ewing,	McGraw Hill Pub, 1975.

Semester	**VI**
Course Code	**CHM 316**
Course Title	**Analytical Method in Chemistry (Practical)**
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** 1.Impart practical knowledge of analytical methods of chemical analysis. 2.Impart practical knowledge to use latest instrumentation and they learn to detect analytes in a mixture.
Course Outcome	**By the end of this course, students will be able to:** CO1Perform experiment with accuracy and precision. CO2 Perform various types of titrations i.e redox, colorimetric, complexometric and acid- base titration. CO3 Determine composition of soil, water analysis, Estimation of macronutrients using Flame Photometery CO4 Learn separation of analytes by chromatography.

I. Separation Techniques

Chromatography:

1. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
2. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.
3. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC
4. Separation of compounds using column chromatography.

II. Solvent Extractions:

1. 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.
2. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
3. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

III Analysis of soil and water:

1. Determination of pH of soil.
2. Total soluble salt
3. Estimation of calcium, magnesium, phosphate, nitrate
4. Determination of physical and chemical parameters of water .
5. Determination of dissolved oxygen in water.
6. Determination of chemical oxygen demand (COD).
7. Determination of Biological oxygen demand (BOD).

IV 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.

V Spectro-photometry

1. Verification of Lambert-Beer's law and determination of concentration of a coloured species (CuSO4, KMnO4, CoCl2, CoSO4)
2. Determination of pKa values of indicator using spectrophotometry.
3. Structural characterization of compounds by infrared spectroscopy.

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	AllegnBecon, Latest edition
7	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

Semester	**VI**
Course Code	**CHM320**
Course Title	**Inorganic Materials of Industrial Importance**
Type of course	DSE
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc I and B.Sc II year with as Chemistry as core subject
Course Objective (CO)	**The aim of this course is to** 1. Introduces learners to the diverse roles of inorganic materials in the industry. 2. Gives an insight into how these raw materials are converted into products used in day to day life. 3.Learn about silicates, fertilizers, surface coatings, batteries, and engineering materials for mechanical construction as well as theemerging area of nano-sized materials. 4.Helps develop the interest of students in the frontier areas of inorganic and material chemistry.
Course Outcomes	**By the end of the course, the students will be able to:** CO1 Learn the composition and applications of the different kinds of glass. CO2 Understand glazing of ceramics and the factors affecting their porosity. CO3 Give the composition of cement and discuss the mechanism of setting of cement. CO4 Explain the suitability of fertilizers for different kinds of crops and soil. CO5 Explain the process of formulation of paints and the basic principle behind the protection offered by the surface coatings. CO6 Explain the principle, working and applications of different batteries. CO7 List and explain the properties of engineering materials for mechanical construction used in day to day life. CO8 Explain the synthesis and properties of nano-dimensional materials, various semiconductor and superconductor oxides.

Unit I

Silicate Industries *Glass:* Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit II

Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

Unit III

Batteries: Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Unit IV

Catalysis: General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Phase transfer catalysts, application of zeolites as catalysts.

Chemical explosives: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, WileyPublishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, WileyPublishers, New Delhi.
4. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
7. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut(1996).

Semester	**VI**
Course Code	**CHM322**
Course Title	**Inorganic Materials of Industrial Importance Practical**
Type of course	DSE
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc I and B.Sc II year with as Chemistry as core subject
Course Objective (CO)	**The aim of this course is to** 1.Introduces learners to the diverse roles of inorganic materials in the industry. 2.Gives an insight into how these raw materials are converted into products used in day to day life. 3. Learn about silicates, fertilizers, surface coatings, batteries, engineering materials for mechanical construction. 4. Helps develop the interest of students in the frontier areas of inorganic and material chemistry.
Course Outcomes	**By the end of the course, the students will be able to:** Able to perform qualitative and quantitative analysis of industrially important chemicals. Able to analyse composition of alloy, cement and fertilizers Able to prepare industrially significant pigments.

List of Experiments:

1. Electroless metallic coatings on ceramic and plastic material.
2. Determination of composition of dolomite (by complexometric titration).
3. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
4. Analysis of Cement.
5. Preparation of pigment (zinc oxide).
6. Detection of constituents of Ammonium Sulphate fertilizer (Ammonium and Sulphate ions) by qualitative analysis and determine its free acidity.
7. Detection of constituents of CAN fertilizer (Calcium, Ammonium and Nitrate ions) fertilizer and estimation of Calcium content.
8. Detection of constituents of Superphosphate fertilizer (Calcium and Phosphate ions) and estimation of phosphoric acid content.
9. Detection of constituents of Dolomite (Calcium, Magnesium and carbonate ions) and determination of composition of Dolomite (Complexometric titration).
10. Analysis of (Cu, Ni) in alloy or synthetic samples (Multiple methods involving Complexometry, Gravimetry and Spectrophotometry).
11. Analysis of (Cu, Zn) in alloy or synthetic samples (Multiple methods involving Iodometry, Complexometry and Potentiometry).

Reference Books:

1. E. Stocchi: *Industrial Chemistry,* Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley
3. Publishers, New Delhi.
4. Svehla, G.(1996),Vogel's Qualitative Inorganic Analysis, Prentice Hall. 2. Banewicz, J. J.; Kenner, C.T. Determination of Calcium and Magnesium in Limestones and Dolomites, Anal. Chem., 1952, 24 (7), 1186–1187.

SKILL ENHANCEMENT COURSES of Chemistry

(Semester III - VI)

Semester	**III**
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** 1. make student aware about concepts of analytical Chemistry various spectrophotometric, electroanalytical methods of analysis 2.Exposed students to important separation methods like solvent extraction and chromatography.
Course outcome	**By the end of this course, students will be able to:** CO1 Handle analytical data &Expresses the role of analytical chemistry in science. CO2Determine composition and pH of soil, which can be useful in agriculture CO3Do qualitative and quantitative analysis of water, food adultrants& cosmetics CO4 Estimate macro nutrients using Flame photometry & Separate mixtures using separation techniques

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:

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.

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).

Unit III:

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.

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 trace 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	Analytical Chemistry,	Christian, G.D. (2004),	John Wiley & Sons.
2	Principles of Instrumental Analysis,	Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005),	Thomson Asia Pvt. Ltd.
3	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
4	Instrumental Analysis	G.D. Christian and J.E.G. Reily	AllegnBecon, Latest edition
5	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

Semester	**IV**
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** 1.Impart coherent knowledge principles and scope of Green chemistry. 2. To study applications of green chemistry in current scenario.
Course outcome	**By the end of this course, students will be able to:** CO1 Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. CO2 Analyze a process and identify parameters that make environmentally friendly/sustainable/green. CO3 Learn to design safer chemical ,products and processesthat are less toxic, than current alternatives. CO4 Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.

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.

UnitIV

Practical Aspects: 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 ChemicalSociety,Washington
4	Introduction to Green Chemistry, 2002	Ryan, M.A. &Tinnesand, M.	American Chemical Society, Washington

Semester	**V**
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 aims of this course to** 1.Provide students with a basic scientific and technical understanding of the production, behaviour and handling of hydrocarbon fuels and lubricants, including emerging alternative & renewable fuels. 2.Enable them to be industry ready to contribute effectively in the field of petroleum chemistry and technology.
Course outcome	**By the end of this course, students will be able to:** CO1 Understanding of both conventional petroleum-based fuels, and alternative & renewable fuels, including gaseous fuels. CO2understand the refining processes used to produce fuels and lubricants and their usage in different applications. CO3 Analyze origin of petroleum, crude oil, composition, different refining processes employed industrially to obtain different fractions of petroleum. CO4Catagorize alternative and renewable fuels like Biofuels (Different generations), Gaseous Fuels (e.g. CNG, LNG, CBG, Hydrogen etc.). CO5 Apply various test methods used to qualify different types of fuels as well characterization methods.

Unit I:
Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value. Determination of calorific value by Bomb calorimeter and Junker's calorimeter.
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, Refiningand 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).

Semester	**VI**
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 aimof this course is to** 1.Develop basic understanding of drugs discovery, design, development and their side effects, 2An overview of fermentation process and production of certain dietary supplements and certain common antibiotics.
Course outcome	**By the end of this course, students will be able to:** CO1Gain insight into retro-synthesis approach in relation to drug design and drug discovery. CO2Learn synthetic pathways of major drug classes. CO3Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins.

Unit 1

Introduction

Drug discovery, design and development: Sources of drugs: biological, marine, minerals and plant tissue culture, physio-chemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action, drug receptor interaction, basic retro-synthetic approach for development of drug. Cause of side effect of drugs like ibuprofen, cetirizine, thalidomide. Difference between drug and poison.

Unit II

Drugs and Pharmaceuticals

Study of pharmaceutical aids like talc, diatomite, kaolin, bentomite, gelatin and natural colours. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), central nervous system agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Unit III

Fermentation

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

UnitIV

1. Preparation of aspirin and its analysis.
2. Preparation of paracetamol and its analysis.
3. Preparation of sulphacetamide of sulphonamide and its analysis.
4. Determination of alcohol contents in liquid drugs/galenical.
5. Determination of ascorbic acid in vitamin C tablets by iodometric or coulometric titrations.
6. Synthesis of ibuprofen.
7. Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry.

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	Hakishan, V.K. Kapoor	Vallabh

	Chemistry,		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

Semester	**VI**
Course Code	**CHM 324**
Course Title	Chemistry of Cosmetics and Perfumes
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** 1. Introducethe students of chemistry to the world of cosmetic chemistry. 2.Impart the theoretical and practical knowledge on basic principles of cosmetic chemistry, manufacture, formulation of various cosmetic products.
Course outcome	**By the end of this course, students will be able to:** CO1.Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products. CO2. Learn the use of safe, economic and body-friendly cosmetics CO3. Prepare new innovative formulations.

Unit I

Cosmetics- Definition, History, Classification, Ingredients, Nomenclature, Regulations. Face Preparation: Structure of skin, Face powder, Compact powder, Talcum powder.

UnitII

Skin Preparation: Face cream, vanishing cream, cold cream, suntan cream, lather shaving cream,

Hair preparation: Structure of hair, classification of hair, Hair dye- classification – temporary, semipermanent, demi permanent, permanent, formulation, hair sprays, shampoo- types of shampoo, conditioners

Unit III

Colored preparation: Nail preparation Structure of nail, Nail lacquers, Nail polish remover Lipsticks , Personal hygiene products: Antiperspirants and deodorants, oral hygiene products, flavours and essential oils

UnitIV

Practicals

Preparation of: 1. Talcum powder. 2. Shampoo. 3. Enamels. 4. Face cream. 5. Nail polish and nail polish remover. 6. Hand wash 7. Hand sanitizer 8. Body lotion 9. Soap 10. Tooth powder 11. Tooth paste

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Handbook of Cosmetic Science and Technology,	Barel, A.O.; Paye, M.; Maibach, H.I.(2014)	CRC Press.
2	Text Book of Cosmetics	Garud, A.; Sharma, P.K.; Garud, N. (2012),	Pragati Prakashan
3	Pharmaceutics and Cosmetics,	Gupta, P.K.; Gupta, S.K.(2011),	Pragati Prakashan
4	Poucher's Perfumes, Cosmetic and Soap,	Butler, H. (2000),	Springer
5	Chemistry of Cosmetics	Kumari, R.(2018),	Prestige Publisher

SCHEME & SYLLABUS
of
MATHEMATICS
for
B.Sc NonMedical

3 year programme

CORE COURSES

(Semester I-IV)

SEMESTER Ist

Semester	**I**
Course Code	**MAT101**
Course Title	**Calculus and Matrices**
Type of course	Theory
L T P	5: 1:0
Credits	6
Course prerequisite	10+2 with Mathematics as core subject
Course Objective (CO)	**The aim of the subject is to** 1. Introduce calculus Students will be familiarized to the concepts and applications of limits, derivatives, integrals and Matrices. 2. Introduce the hyperbolic function , derivatives.
Course outcomes	**By the end of the course, students will be able to:** CO1 Locate the x and y intercepts, any undefined points, and any asymptotes. CO2 Apply the concept of derivative to completely analyze graph of a function. CO3 Solve Taylor's series, Maclaurin's series CO4 Understand the concept of diagonal, normal for of matrices and applications of matrices in other fields

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, Maxima and Minima.

Unit-IV

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3, Reduction to normal form, Orthogonal transformation and quadratic to canonical forms. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, and Statistics.

Text and Reference books:

Sr No.	Book Title	Author	Publisher
1	Calculus	H. Anton, I. BirensAnd S. Davis	John Wiley And Sons
2	Calculus	G.B. Thomas And R.L. Finney	Pearson Education
3	Introduction to Algebra	A.I. Kostrikin	Springer Verlag
4	Theory and Problems of Matrix Operations	Richard Bronson	Tata McGraw Hill

SEMESTER IInd

Semester	**II**
Course Code	**MAT102**
Course Title	**Differential Equations**
Type of course	Core
L T P	5: 1: 0
Credits	6
Course prerequisite	10+2 with Mathematics as core subject
Course Objective (CO)	**The aim of the subject is to** 1. Develop the knowledge about Differential Equations and partial equations. 2. Develop the knowledge of Wronskian properties.
Course Outcomes (CO)	**By the end of the course, students will be able to:** CO1 Find out the General, particular, explicit, implicit, and singular solutions of a differential equation. CO2 Understand the concept of Wronskian: its properties, its applications, and Linear homogeneous and non-homogeneous equations of higher order with constant coefficients. CO3 Solve Partial differential equation with Lagrange's solution and Charpit's general method of solution. CO4 Use Laplace transformation to solve differential equation

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

Partial differential equation: Formation of first and second order equations, linear equation of first order, integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces. Nonlinear first order partial differential equations: Charpit's method, Higher order linear partial differential equations with constant coefficients: complementary function, particular integral.

Unit-IV

Laplace transforms. Introduction to infinite integrals. Linearity of Laplace transforms. Existence theorem for Laplace transforms. Laplace transforms of derivative sand integrals. Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using Laplace transforms.

Text and Reference Books:

Sr No.	Book Title	Author	Publisher
1	Differential Equations	Shepley L. Ross	John Wiley and Sons
2	Elements of Partial Differential Equations	Sneddon	McGraw-Hill
3	Laplace Transforms	Murray Spiegel	McGraw-Hill Education

SEMESTER IIIrd

Semester	**III**
Course Code	**MAT201**
Course Title	**Real analysis**
Type of course	Theory
L T P	5: 1: 0
Credits	6
Course prerequisite	B.Sc. /B.A. 1st year with Mathematics as core subject
Course Objective	**The aim of the subject is to** 1. Have the knowledge of basic properties of field of real numbers, convergence of sequences and metric space. 2. Develop knowledge of finite infinite sets,Cauchy theorem.
Course Outcomes (CO)	**By the end of the course, students will be able to:** CO1 Understand and find the Bounded and unbounded sets, Infimum and supremum of a set. CO2 Learn Bolzano- Weierstrass theorem for sets, topology of real line and Rn. CO3 Understand the theorems on limits of sequences, Subsequences, Monotone sequences, Monotone convergence Theorem. CO4 Study the basic concept of metric space.

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. Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences.

UNIT-II

Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof). 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).

UNIT-III

Definition and examples of absolute and conditional convergence. Sequences and series of functions, Pointwise and uniform convergence. M_n-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence

UNIT-IV

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

Text and reference books:

Sr No.	Title	Author	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
4	Introduction to Real Analysis	R.G. Bartle and D. R Sherbert	John Wiley and Sons

SEMESTER IVth

Semester	**IV**
Course Code	**MAT202**
Course Title	**Algebra**
Type of course	Theory
L T P	5: 1: 0
Credits	6
Course prerequisite	B.Sc. /B.A. 1st year with Mathematics as one core subject
Course Objective (CO)	**The aim of this course is to** 1. Make the students learn fundamental concepts of Groups, Ring, Field and trigonometry concepts. 2.Learn the concept of group theory, Devier theorem.
Course Outcomes (CO)	**By the end of the course, students will be able to:** CO1 Have a working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element. CO2 Be knowledgeable of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups. CO3 Understand the concept of De-Moivre's theorem and expansion of trigonometric functions.

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

UNIT-IV

De-Moivre's theorem and applications. Direct and inverse, circular and hyperbolic, functions. Logarithm of a complex quantity, Expansion of trigonometric functions.

Text and reference books:

S. No.	Title	Author	Publisher
1	A First Course in Abstract Algebra	John B. Fraleigh	Pearson
2	Abstract Algebra	M. Artin	Pearson
3	Contemporary Abstract Algebra	Joseph A Gallian	Narosa
4	Metric Spaces	Satish Shirali and Harikishan L. Vasudeva	Springer Verlag, London

DISCIPLINE ELECTIVE COURSES (Semester V - VI)

SEMESTER

Vth

Semester	**V**
Course Code	**MAT301**
Course Title	**Numerical Method**
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1:0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The main aim of this course is to** 1. students will be familiar the students with the notation and terminology related to finding the errors, significant numbers 2. to interpolate the problems using numerical methods
Course Outcomes (CO)	**By the end of the course, students will be able to**: CO1 Find numerical solutions of algebraic and transcendental equations. CO2 Obtain numerical solutions of system of linear equations and check the accuracy of the solutions. CO3 Solve initial and boundary value problems in differential equations using numerical methods.

Unit-I

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit-II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit-III

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation**.**

Unit-IV

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	A Friendly Introduction to Numerical Analysis	Brian Bradie	Pearson Education
2	Numerical Methods for Scientific and Engineering Computation,	M.K. Jain, S.R.K. Iyengar and R.K. Jain	6th Ed., New ageInternationalPublisher , India, 2007.
3	Applied Numerical Analysis	C.F. Gerald and P.O. Wheatley	Pearson Education, India, 2008

Semester	**V**
Course Code	**MAT303**
Course Title	**Linear Algebra**
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1:0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The main aim of this course is to** 1. Provide the knowledge of basic Quotient Space, linear transformation, invertibility and Isomorphism on vector space. 2. Provide knowledge of vector spaces, dimensions.
Course Outcomes (CO)	**By the end of the course, students will be able to**: CO1 Identify many of familiar systems as vector spaces and operate with them using vector space tools such as basis and dimension. CO2 Understand linear transformations and manipulate them using their matrix representations. 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	Pearson
3	Introduction to Linear Algebra	S. Lang,	Springer
4	Linear Algebra and its Applications	Gilbert Strang	Cengage Learning

.

Semester	**V**
Course Code	**MAT307**
Course Title	**Theory of Equations**
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1: 0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The aim of this course is to** 1. Impart knowledge to the students about theory of equations. 2. Impart knowledge of Polynomial, symmetric functions.
Course Outcomes (CO)	**By the end of the course, students will be able to:** CO1 Understand the basic concept of polynomials and its significance properties. CO2 Lean about the Descarte's rule of signs positive and negative rule and Relation between the roots and the coefficients of equations. CO3 Understand the Symmetric functions and the Strums theorem and its applications.

Unit-I

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Unit-II

Symmetric functions, Applications of symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

Unit-III

Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations, Separation of the roots of equations.

Unit-IV

Strums theorem, Applications of Strum's theorem, Conditions for reality of the roots of an equation and biquadratic. Solution of numerical equations.

Text and reference books

S. No	Name	Author(S)	Publisher
1	The Theory of Equations	W.S. Burnside and A.W. Panton	Dublin University Press, 1954
2	Theory of Equations	C. C. MacDuffee	, John Wiley & Sons Inc., 1954
3	Higher Algebra	Hall and Knight	Arihant

SEMESTER VIth

Semester	**VI**
Course Code	**MAT302**
Course Title	Integral Calculus
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1:0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The aim of this course is to** 1. Impart practical knowledge to the students about integrals of functions of two, three variables, Riemann Integral and improper Integral.
Course Outcomes	By the end of the course, students will be able to: CO1 Find the areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. CO2 Solve the double and triple integration CO3 Understand the concept of Riemann Integral and to solve the improper integrals.

UNIT I:
Integrals of functions of two variables, double integrals, Applications to evaluation of area, volumes and surfaces of solids of revolution, Change of order of Integration. Change of variables.
UNIT II:
Integrals of functions of three variables, Triple integral, Evaluation of volume, density etc., Change of order of Integration. Change of variables. Implicit and Explicit functions, Integration of hyperbolic and inverse hyperbolic functions.
UNIT III:
Riemann Integral. Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus.
UNIT IV:
Convergence of improper integrals. Comparison tests, Abel's and Dirichlet's tests. Beta and Gamma functions. Frullani's integral. Integral as a function of a parameter, and its continuity, differentiability, and integrability.

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	John Wiley
3.	Elementary Analysis, The Theory of Calculus	K.A. Ross	Springer

Semester	**VI**
Course Code	**MAT306**
Course Title	Complex Analysis
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1:0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The aim of this course is to** 1. Develops the knowledge of analytic function ,derivative function and Cauchy-Riemann equation
Course Outcomes	By the end of the course, students will be able to: CO1 Demonstrate accurate and efficient use of complex analysis techniques. CO2 Express analytic functions in terms of power series and Laurent series. CO3 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
3	Complex Analysis	J.V Deshpande Tata McGraw-Hill	Publishing Company

Semester	**VI**
Course Code	**MAT308**
Course Title	Introduction to Operation Research
Type of course	Discipline Elective Courses (Theory)
L T P	5: 1:0
Credits	6
Course prerequisite	B.Sc. /B.A. Ist, IInd with Mathematics as one core subject
Course Objective	**The aim of this course is to** 1. Help to understand Simplex Method, Big M Method, and Primal – dual Relationship. 2. Understand the concept of operation research.
Course Outcomes	By the end of the course, students will be able to: CO1 prepare model a problem as a linear programming problem and to apply the appropriate method in order to find an optimal solution. CO2 Find primal – dual Relationship. CO3 Use transportation and game theory in real life problem.

UNIT I

Introduction to operational research: features, models,limitation.Introduction to linear programming problem their problem formulations .Graphical solution of linear programming problems , simplex method, Big- M method.

UNIT II

Primal dual relationship, formulation of dual problems. Duality in linear programming, economic interpretation of duality.

UNIT III

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method. Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

UNIT IV

Game theory: formulation of two person zero sum games, solving two person zero sum games,Games with mixed strategies, graphical solution procedure

Text and Reference Books

S. No	Name	Author(S)	Publisher
4.	Linear programming and Network flows	Mokhtar S. Bazaraa	John Wiley and Sons
5.	Linear programming	Mokhtar S. Bazaraa	Tata McGraw Hill
6.	Operations Research, An Introduction	Hamdy A. Taha	Prentice- Hall India

SKILL ENHANCEMENT COURSES of Mathematics

(Semester III - VI)

Semester	**III**
Course Code	**MAT207**
Course Title	**Logic and Graph theory**
Type of course	**Skill Enhancement Courses**
L T P	200
Credits	2
Course prerequisite	B.Sc. /B.A. 1st year with Mathematics as one core subject
Course Objective	**The aim of the subjects is** 1. That students have basic knowledge of sets, relation and graph theory. 2. Learn logic truth tables,propositional equivalence, relations, graph.
Course Outcome	**By the end of the course, students will be able to:** CO1 Demonstrate the ability to write and evaluate a proof in Logics. CO2 Write an argument using logical notation and determine if the argument is or is not valid. CO3 Use Graphs in Networking & other engineering problems.

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

Relations, types of relation, matrix of relation, product sets and partitions , Equivalence Relations with example of congruence modulo relation, hasse diagram and digraph, path in relation and digraphs, functions, types of functions.

Unit IV

Graphs(directed and undirected),types of graphs, Euler‘s paths and circuits, Hamiltonian paths and circuits, colorings of graphs , partially ordered sets, external elements of poset, lattices, lattices as algebraic system, finite Boolean.

Text and Reference Books

S.No	Title	Author(s)	Publisher
1	Discrete Mathematics and Combinatorial Mathematics	R.P. Grimaldi	Pearson Education (Singapore) P. Ltd
2	Naive Set Theory	P.R. Halmos	Springer
3	Discrete Mathematics with Graph Theory	Edgar G. Goodaire and Michael M. Parmenter	Pearson Education (Singapore) P. Ltd

Semester	**IV**
Course Code	**MAT208**
Course Title	**Number theory**
Type of course	Theory
L T P	2 00
Credits	2
Course prerequisite	B.Sc. /B.A. Ist, IInd year with Mathematics as core subject
Course Objective (CO)	**The aim of the subjects to** 1. Develops the knowledge about number theory and combinations of numbers. 2. Develop skills of doing examples of division algorithm, phi function.
Course Outcome	**By the end of the course, students will be able to:** CO1 Gain the knowledge of divisibility and related algorithm CO2 Solve the Diophantine equations. CO3 Understand and gain the knowledge of Mobius inversionformula, Euler's phi functions, the greatest integer functions.

UNIT-I

Division algorithm, GCD, Euclidean Lemma, Lame‘s theorem(Statement only), linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem..

UNIT-II

Euler‘s phi-function, Congruence, Basic Properties of congruence, 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

Goldbach‘s conjecture, binary and decimal representation of integers, Mobius inversion formula, the greatest integer function.

Text and reference books:

S. No.	Title	Author	Publisher
1	Elementary Number Theory	David M. Burton	Tata McGraw-Hill
2.	Beginning Number Theory	Neville Robinns	Narosa Publishing
3.	Computational Number Theory (Discrete Mathematics and Its Applications)	Abhijit Das	Chapman and Hall/CRC

Semester	**V**
Course Code	**MAT305**
Course Title	**Vector Calculus**
Type of course	Skill enhancement course
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc. /B.A. Ist, IInd year with Mathematics as core subject
Course Objective	**The aim of the subjects to** 1. Learn the students about vector function, field, and its properties and apply different operations on vector field. 2.Learn basic of vector analysis.
Course Outcome	**By the end of the course, students will be able to:** CO1 Learn the concept of differentiation and partial differentiation of vector functions. CO2 Solve the derivatives of sum, dot product, and cross product of two vector functions. CO3 Find the gradient, divergence and curl of vector functions.

Unit I

Scalar product and its geometric interpretation, norm, angle between two vectors, the triangle inequality, cross product, and its geometric interpretation.

Unit II

Scalar and Vector fields, gradient fields and potentials, flow line, gradient, divergence, curl and the del operator, Orthogonal curvilinear coordinates

Unit III

Scalar and vector line integrals, work, line integrals along curves, Green‘s theorem and divergence theorem in plane.

Unit IV

Scalar and vector surface integrals with interpretations, Stokes theorem, Volume integrals, Gauss Divergence Theorem.

Text and reference books:

S. No.	Title	Author	Publisher
1	Calculus	H. Anton	John Wiley and Sons
2.	Vector Calculus	P.C. Matthew‘s	London Limited
3.	A Textbook of Vector Calculus	Shanti Narayan , P.K. Mittal	S Chand; 4th edition

Semester	**VI**
Course Code	**MAT310**
Course Title	Probability and Statistics
Type of course	Skill enhancement course
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc. /B.A. Ist, IInd year with Mathematics as core subject
Course Objective	**The aim of this course is to** 1. Provide knowledge with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and sciences. 2. understand probality and statistic in more detail
Course Outcome	**By the end of the course, students will be able to:** CO1 Learn about random variables (discrete and continuous) and discrete and continuous distributions CO2 Understand Joint cumulative distribution function , its properties and the concept of bivariate normal distribution and correlation coefficient CO3 Understand and solve the concept of Measures of Central tendency and dispersion.

UNIT-I

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments

UNIT-II

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function.

UNIT-III

Discrete distributions: uniform, binomial, Poisson, cumulative distribution function and its properties

UNIT-IV

Normal, exponential. Joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations.

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Introduction to Mathematical Statistics	Robert V. Hogg, Joseph W. McKean and Allen T. Craig	Pearson Education, Asia, 2007
2	Mathematical Statistics with Applications	Irwin Miller and Marylees Miller, John E. Freund	7th Ed., Pearson Education, Asia, 2006
3	Fundamentals of Statistics	Gupta M.K. and Dasgupta B.	8th Edn. The World Press, Kolkata., 2002
4	Fundamentals of Mathematical Statistics	S.C. Gupta, V.K. Kapoor	Sultan Chand & Sons,2014.

(AECC)

Ability Enhancement Compulsory Courses

Semester I - VI

Semester	**I**
Course Code	**ENG121**
Course Title	**Communication skills-I**
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	+2 with any stream
CourseObjective (CO)	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcome	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and command in official/ corporate communication. 3. Develop confidence in making presentation: oral or documentary.

UNIT-I

Basics of Communication Skills: Communication, Process of Communication, Types of Communication-Verbal and Non-verbal communication, Channels of Communication-Upward, Downward, Horizontal, Barriers to Communication, Role of Communication in society.

UNIT-II

Listening Skills: Listening Process, Hearing and Listening, Types of Listening, Effective Listening, Barriers to Effective Listening, Note Taking.

Reading Skills: Purpose of reading, Process of reading, Reading skills Models and strategies, scanning, skimming, SQ3R, Approaches of Reading, Comprehension passages for practice.

UNIT III

Writing Skills: Purpose of writing, Effective writing, Types of writing, Business Correspondence, Precis writing, Memo writing, Minutes of meeting.

UNIT-IV

Speaking Skills: Speech process, Skills for effective speaking, Role of audience, Feedback Skill, Oral Presentation.

Recommended Books:

Sr No	Author(s)	Title	Publisher
1.	BhupenderKour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

Semester	**I**
Course Code	**ENG123**
Course Title	**Communication Skills-1 Lab**
Type of Course	Practical
L T P	0 0 2
Credits	1
Course pre-requisite	NA
Course Objectives	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcome	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I

Speaking and Discussion Skills: Oral Presentation, Planning and organizing content for presentation, Use of audio /visual Aids, Making Slides for presentation , Group Discussion ,Debate, Extempore speaking, Interview Skills, Mock interview, Mock Dialogues (Pair Speaking),Cue Card Speaking, Meeting/ Conferences.

UNIT-II

Listening Skills: Listening to any recoded material and asking oral/written questions for listening comprehension. **Reading Skills:** Active reading of passages for Reading comprehensions, paraphrase, Summary writing.

UNIT-III

Writing Skills: Guidelines of effective writing, Paragraph Writing, Email Writing.

UNIT-IV

Grammar and Vocabulary:

Parts of Speech, Tenses, GRE words (List of 50 Words).

Recommended Books:

Sr No	Author(s)	Title	Publisher
1.	BhupenderKour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

Semester	**II**
Course Code	**ENG114**
Course Title	**Communication Skills-II**
Type of Course	Theory
LTP	2 0 0
Credits	2
Course pre-requisite	NA
Course Objectives (CO)	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcome	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I

Grammar: Parts of Speech, Use of appropriate tense, Voice , Reported Speech, Sentence Structure; Simple, Compound, Complex, Vocabulary-One word substitution.

UNIT-II

Writing Skills: Application for employment , Resume Writing ,Paragraph Writing Construction-Kinds of Paragraphs, Preparing of Matter for meeting : Notice, agenda, Conference

UNIT-III

Speaking Skills: Effective oral Presentation, Slide making, Use of audio-visual aids.

UNIT-IV

Oral Communication and its Application:

Group Discussion, Customer Care Relations (PR Skills), Interview Skills (Conducting and appearing for interviews), and Telephone handling manners.

Recommended Books

S.no	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company,
2	Media and Communication Management	C. S. Rayudu	- Himalaya Publishing House,
3	Essentials of Business Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi

Semester	**II**
Course Code	**ENG116**
Course Title	**Communication Skills-II Lab**
Type of Course	Practical
L T P	0:0:2
Credits	1
Course pre-requisite	+ 2 with any stream
Course Objectives	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension.. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcome	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I
Grammar:
To recognize part of speech of particular word in given sentence, To use appropriate tense , Exercise on: Voice, Reported speech and Sentence Structure, Vocabulary-One word substitution.

UNIT-II
Writing Skills:
Job Application, Resume Writing, Paragraph Writing, Preparing of Matter for meeting: Notice, agenda, Conference.

UNIT- III
Speaking Skills: How to deliver an effective power point Presentation, Slide making, Effective use of audio Visual aids,

UNIT-IV
Oral Communication and its Application:
Group Discussion, Mock Interview (Conducting and appearing for interviews), and Role plays. Conducting a successful official meeting.

Recommended Books

S. No	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company,
2	MediaandCommunication Management	C. S. Rayudu	- Himalaya Publishing House,
3	EssentialsofBusiness Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi

Semester	**III**
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 environemntalassetsriver/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	ErachBharucha	
2	Environmental Biology,	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
3	Environmental Science,	Miller T.G. Jr.	Wadsworth

Semester	**IV**
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.*

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

Semester	VI
CourseCode	**CSE014**
CourseTitle	**Basics of Computer Sciences**
TypeofCourse	Theory
L T P	2 00
Credits	2
CoursePrerequisites	Basic of Computer
Course Objectives(CO)	Tounderstandthebasicconceptsofcomputer,officeautomation,informationtechnologyandinternet.
Course Outcomes	The students will be able to: 1. Understand basics of computer and its operating system 2. Distinguish the types of software Learn the MS-Windows basics and applications

UNIT-I
IntroductiontoComputers
Define a Computer System, Block diagram of a Computer System and its working, Applicationsofcomputersystem,InputandOutputdevice,memories,RAM,ROM,secondarystoragedevices,ComputerSoftwareandHardware.

UNIT-II
OperatingSystem: Definition,Needforoperatingsystem,Functionsofoperatingsystem(ProcessorManagement,MemoryManagement,FileManagementandDeviceManagement),Workingwith GUIoperatingSystem.
ComputerLanguages: Machinelanguage,assemblylanguage,higherlevellanguage.

UNIT-III
WorkingKnowledgeofComputerSystem
WordProcessor-
Introductiontowordprocessorsanditsfeatures,creating,editing,printingandsavingdocuments, spellcheck, mail merge
PowerPoint:creatingpowerpointpresentations,creatingspreadsheetsandsimplegraphs,evolutionofInternet anditsapplicationsand services.
Spreadsheets-
Introductiontospreadsheetsanditsfeatures,Usingdifferenttypesofformulae,Creatinggraphsandcharts, Exportingcharts to word processor.

UNIT-IV
IntroductiontoInformationTechnology: Introduction to InformationTechnology and itsapplications.
Introductionofinternet-
Definition,Applicationsofinternet,ImpactofInternetonSocietyCrimeon/through theInternet, E-mail, WWW.

TextandReferenceBooks

Sr.no.	Name	Author(s)	Publisher
1	FundamentalsofComputers	R.S.Salaria	Salaria PublishingHouse
2	ComputerFundamentals	P.K. Sinha and	BPBPublication
3	Absolute Beginners Guide toComputerBasics	MillerM	PearsonEducation
4	MSOfficeforWindows XP	SagmanS	PearsonEducation

Semester	**VI**
CourseCode	**CSE016**
CourseTitle	**Basicsof ComputerSciences Lab**
Typeof course	Practical
L T P	002
Credits	1
Courseprerequisite	NA
Course Objective(CO)	Tofamiliarizeallthestudentswithbasicconceptsofcomputersincludingof ficeautomation and internet concepts.
Course outcomes	The students will be able to: 3. Understand basics of computer and its operating system 4. Distinguish the types of software Learn the MS-Windows basics and applications

LISTOFEXPERIMENTS

1. GivenaPC,nameitsvariouscomponentsandperipherals.Listtheirfunctions
2. **InstallationofoperatingSystemviz.WindowsXP,Windows2007etc.**

FeaturesofWindowsasanoperatingsystem

- Start
- Shutdownandrestore
- Creatingandoperatingontheicons
- Openingclosingandsizingthewindows
- Usingelementary jobcommandslike– creating,saving,modifying,renaming,findinganddeleting afile
- Creatingandoperatingonafolder
- Changingsettinglike,date,time,colour(back groundandforeground)
- Usingshortcuts

3. **UsingonlinehelpWordProcessing(MSOffice/OpenOffice)**

a) FileManagement:
Opening,creatingandsavingadocument,locatingfiles,copyingcontentsinsomedifferentfile(s),protecting files,givingpassword protection for a file

b) PageSetup:
Settingmargins,tabsetting,ruler,indenting

c) Editingadocument:
Enteringtext,Cut, copy,pasteusingtool-bars

d) Formattingadocument:
Usingdifferentfonts,changingfontsizeandcolour,changingtheappearancethroughbold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using differentunderlinemethods

- Aligningoftext in adocument,justificationofdocument,Insertingbulletsandnumbering
- Formattingparagraph, insertingpagebreaksandcolumnbreaks,linespacing
- Useofheaders,footers:Insertingfootnote,endnote,useofcomments
- Insertingdate,time,specialsymbols,importinggraphicimages,drawingtools

e) Tablesand Borders:
Creatingatable,formattingcells,useofdifferentborderstyles,shadingintables,mergingofcells,partitionofce lls, insertinganddeletingarowinatable
Printpreview,zoom, pagesetup,printingoptionsUsingFind, Replaceoptions

f) UsingTools like:
Spellchecker,help,useofmacros,mailmerge,thesauruswordcontentandstatistics,printingenvelopsand lables
Usingshapes and drawingtoolbar,
Workingwithmorethanonewindow in MSWord,
Conversionbetweendifferenttexteditors,softwareandMSword

4. **SpreadSheetProcessing(MSOffice/OpenOffice)**

a) Startingexcel,openworksheet,enter,edit,data,formulaetocalculatevalues,formatdata,createch art,printingchart, saveworksheet, switchingbetweendifferentspread sheets

b) Menucommands:
Create,formatcharts,organize,managedata,solvingproblembyanalyzingdata,exchangewithotherapplications. ProgrammingwithExcelWorkSheet,gettinginformation while working

c) Work books:

5. PowerPointPresentation(MSOffice/OpenOffice)

a) IntroductiontoPowerPoint

a. Howtostart PowerPoint
b. Workingenvironment:conceptoftoolbars,slidelayout,templatesetc.
c. Openinganew/existingpresentation
d. Differentviewsforviewingslidesinapresentation:normal, slidesorteretc.

b) Addition,deletionandsavingofslides

c) Insertionofmultimediaelements

e. Addingtextboxes
f. Adding/importingpictures
g. Addingmoviesand sound
h. Addingtablesandcharts etc.
i. Addingorganizationalchart

d) Formattingslides

j. Usingslidemaster
k. Textformatting
l. Changingslidelayout
m. Changingslidecolourscheme
n. Changingbackground
o. Applyingdesign template

- Howtoviewtheslideshow?

Semester	**III-VI**
CourseCode	**PHY320**
CourseTitle	**Practical Training**
Typeof course	Practical
L T P	0 0 72
Credits	NC
Courseprerequisite	NA
Course Objective(CO)	The course would develop soft skills of students, scientific aptitude, critical thinking, writing and research presentation.
Course outcomes	The students will be able to: 1. Investigate various practical aspects related to the chemistry, Physics, mathematics and computers. 2. Appreciate the literature and its relevance to his/her topic of interest how to write a report on a given topic. 3.Technical write and presentation on a given topic of training

Practical training of 72 hours (Non credit based) have been included in course curriculum of B.Sc Non Medical: : Students have to complete their practical training in 3 year degree tenure and have to be evaluated on the basis of final submission of report and presentation before the Departmental Committee .

 For report compilation: Student will contact the respective mentors/practical training coordinator at allocated schedule to:

 Conduct the literature survey of the topic/project allotted.

 Prepare a detail report in consultation with mentor.

Students should complete their practical Training during (minimum 72 hours) in intradepartmental and interdepartmental labs/workshops) and the student will give final presentation of their practical training before the departmental committee.