K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF BASIC AND APPLIED SCIENCES

Bachelor of Science (H) Chemistry

B.Sc. (Hons.) Chemistry

Programme Code: 10

2018-21

Approved in the 17th Meeting of Academic Council Held on 29 June 2018

Academic Council
Member Secretary
K.R. Mangalam University

Registrar
K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF BASIC AND APPLIED SCIENCES

Bachelor of Science (H) Chemistry

B.Sc. (Hons.) Chemistry

Programme Code: 10

2018-21

Approved in the 17th Meeting of Academic Council Held on 29 June 2018

Introduction

The K.R. Mangalam Group has made a name for itself in the field of education. Over a period, the various educational entities of the group have converged into a fully functional corporate academy. Resources at KRM have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly inter-disciplinary environment wherein they develop integrative skills through interaction with students from engineering, management, journalism, and media study streams.

The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education. With the mushrooming of institutions of Higher Education in the National Capital Region, the university considered it very important that students take informed decisions and pursue career objectives in an institution, where the concept of education has evolved as a natural process.

K.R. Mangalam University was founded in the year 2013 by Mangalam Edu Gate, a company incorporated under Section 25 of the Companies Act, 1956.

K. R. Mangalam University is unique because of its

- Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
- Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Objectives

- To impart undergraduate, post-graduate and Doctoral education in identified areas of higher education.
- To undertake research programmes with industrial interface.
- To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.
- To act as a nodal center for transfer of technology to the industry.
- To provide job oriented professional education to the pecia student community with particular focus on Haryana.

About the School

VISION

School of Basic and Applied Sciences intends for continuum growth as centre of advanced learning, research and innovation by disseminating analytical and scientific knowledge in the areas of basic and applied sciences by promoting interdisciplinary research and scientific acumen.

MISSION

M1: Enable students to be scientists/ academicians /entrepreneurs by accomplishing fundamental and advanced research in diverse areas of basic and applied sciences.

M2: Build strong associations with academic organizations/industries for knowledge creation, advancement, and application of scientific fervor.

M3: Create conducive environment for lifelong learning.

M4: Empower students to be socially responsible and ethically strong individuals through value-based science education.

The school imparts out both teaching and research through its various science disciplines viz Mathematics, Chemistry and Physics.

School of Basic and Applied Sciences imparts students' technical knowledge, enhances their skill and ability, motivating them to think creatively, helping them to act independently and take decisions accordingly in all their scientific pursuits and other endeavors. It strives to empower its students and faculty members to contribute to the development of society and Nation.

The faculty is in constant touch with various experts in the relevant field and is willing to experiment with the latest ideas in teaching and research.

The School Comprises of Departments of Chemistry, Physics and Mathematics.

Programmes offered by the School

School offers undergraduate B.Sc. (Hons) Programmes and postgraduate M.Sc. Programmes. All these Programmes are designed to impart scientific knowledge to the students and will provide theoretical as well as practical training in their respective fields.

B. Sc. (Hons.) Chemistry

This programme aims to impart basic and applied knowledge in various branches in Chemistry with a view to produce good academics, researchers, and professionals in the field.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science stream with an aggregate of 50% or more.

Course Outline: - Inorganic chemistry / Organic chemistry / Physical chemistry / Analytical methods in chemical sciences / Environmental chemistry / Biochemistry / Green Chemistry.

Career Options: - Opportunities exist in chemical industry, pharmacy, education and forensics.

Programme scheme: - For Programme scheme see Annexure A.

B.Sc. (Hons.) Physics

Physics, as a stream of study, helps in understanding fundamentals and develop curiosity in understanding various physical aspects of universe. This course aims to impart basic and applied knowledge in physics with a view to produce good academicians, researchers and professionals in varied fields.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science stream with an aggregate of 50% or more.

Course Outline: - Mathematical Physics / Mechanics / Optics / Thermal Physics / Oscillations & Waves / Electricity & Magnetism / Numerical Analysis / Digital Electronics / Microprocessor & Computer Programming / Digital Electronics / Quantum Mechanics / Atomic & Molecular Physics
/ Electronic Devices / Electromagnetic Theory / Statistical Physics / Solid State physics / Nuclear
& Particle Physics.

Career Options: - Opportunities exist in academics, research laboratories and administration besides all the opportunities applicable to any other graduate like UPSC examination's, defence services and other govt. jobs.

Programme scheme: - For Programme scheme see Annexure B.

B.Sc. (Hons.) Mathematics

Mathematics is a universal part of human culture. This course aims to impart basic and applied knowledge in Mathematics with a view to produce good Mathematicians and researchers. A degree in mathematics provides you with a broad range of skills in problem solving, logical reasoning and flexible thinking.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science stream with an aggregate of 50% or more.

Course Outline: - Calculus / Vector Calculus / Business Mathematics / Differential Equations / Solid Geometry / Computer Programming / Modern Algebra / Numerical Analysis / Linear Algebra / Real Analysis / Complex Analysis / Probability and Statistics / Operational research / Mechanics.

Career Options: - Mathematicians work in business, finance, industry, government offices, management, education and science.

Programme scheme: - For Programme scheme see Annexure C.

• Program Duration

The minimum period required for the B.Sc. (Hons.) Programme offered by the University shall extend over a period of three Academic Years.

The maximum period for the completion of the B.Sc. (Hons) Programme offered by the University shall be five years.

• Class Timings

The classes will be held from Monday to Friday from 09:10 am to 04:10 pm.

• Scheme of Studies and Syllabi

The syllabi of all courses Programme offered by SBAS are given in the following pages. These are arranged as: (a) common courses (b) degree specific courses, in numeric order of the last three digits of the course code.

For each course, the first line contains Course Code and Credits (C) of the course. This is followed by the course objectives, syllabus (Unit I to IV), Textbook and reference books.

- **Syllabi of Common Courses in all B.Sc. (Hons.) Programme**

BSEL 101 COMMUNICATION SKILLS (Credits-4)

Course Objectives:

The purpose of this course is to understand the basics of Grammar to improve written and oral communication and to speak correct form of English with proficiency in which will improve students' personality and enhance their self-confidence

UNIT I

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication; Literature: A Bird Came Down the Walk by Emily Dickinson

UNIT II

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Types of sentences; Reported Speech; Punctuation; Literature: Stopping by Woods on A Snowy Evening by Robert Frost

UNIT III

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms &Synonyms, Phrasal Verbs, Idioms & Proverbs (25 each); Commonly used foreign words(15 in number); Literature: The Last Leaf by O'Henry

UNIT IV

Personality Development: Etiquette & Manners; Leadership; Inter & intra personal skills; Attitude, Self-esteem & Self-reliance; Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques; Literature: My Prayer to Thee by Rabindranath Tagore;

TEXTBOOK:

1. Kumar, Sanjay and Pushplata. CommunicationSkills. Oxford University Press.

REFERENCE BOOKS / SITES:

- Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. Intermediate Grammar, Usage and Composition. Orient Blackswan.
- Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.
- "Best Poems", http://100.best-poems.net/. HYPERLINK "http://100.best-poems.net/" 20 July 2016.
- "Classic English Short Stories" ,http://www.eastoftheweb.com/short-stories/Collections/ ClasEngl.shtml, 20 July 2016.

BSCS 113 INTRODUCTION TO COMPUTERS AND PROGRAMMING(Credits-3)
Course Objectives:

The objective of the course module is to

- Introduce basics of Computers and its architecture.
- Understand the concepts of Programming using C.

UNIT-I

Introduction to Computer and Programming: Overview of Computer organization and historical perspective computer applications in various fields of science and management. Data representation: Number systems, character representation codes, binary, hex, octal codes and their inter conversions, ASCII, EBCDIC, gray code Binary arithmetic, floating-point arithmetic, signed and unsigned numbers. Concept of algorithms, flow charts, data flow diagrams etc., Concepts of the finite storage, bits bytes, kilo, mega and gigabytes; Concepts of character representation.

UNIT-II

Programming using C: Example of some simple C program. Concept of variables, program statements and function calls from the library (print for example) C data types, int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. C primitive input output using getchar and putchar, exposure to the scan and print functions, C Statements, conditional executing using if, else. Optionally switch and break statements may be mentioned.

UNIT-III

Iterations and Sub programs: Concept of loops, example of loops in C using for, while and do -while. Optionally continue may be mentioned.

One dimensional arrays and example of iterative programs using arrays: 2-d arrays, use in matrix computations; Concept of Sub-programming, functions Example of functions; Argument passing mainly for the simple variables.

UNIT-IV

Digital: Binary representation of decimal number, Octal and Hexadecimal representation, BCD, Signed and Unsigned representation, One's and two's complement, Boolean Algebra, De- Morgan's Law, Logic Gates etc.

TEXTBOOKS

1. Y. Kanetkar, Let us C, BPB Publications.

REFERENCE BOOKS:

- Herbert Scheldt, C: The complete reference, Osbourne McGraw Hill.
- Rajaraman, Fundamentals of Computers, Prentice Hall of India.
- Morris Mano, Digital Design, Pearson's publications.
- Kernighan & Ritchie, C Programming Language, the (ANSI C Version), Prentice Hall of India.
- J. B. Dixit, Fundamental of Computers and Programming in C, Laxmi Publications, New Delhi.

BSCS131 INTRODUCTION TO COMPUTERS & IT, OFFICE AUTOMATION (Credits 4)

Course Objective: The objective of the course module is to

- Introduce basics of Computers and its architecture.
- Understand the concepts of Programming using C.

UNIT I

Introduction to Computer and Programming: Overview of Computer organization and historical perspective computer applications in various fields of science and management. Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions, ASCII, EBCDIC, Gray code Binary arithmetic, Floating-point arithmetic, signed and unsigned numbers. Concept of algorithms, Flow Charts, Data Flow diagrams etc.,

Concepts of the finite storage, bits bytes, kilo, mega and gigabytes. Concepts of character representation.

UNIT II

Programming using C: Example of some simple C program. Concept of variables, program statements and function calls from the library (print for example) C data types, int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. C primitive input output using getchar and putchar, exposure to the scan and print functions, C Statements, conditional executing using if, else. Optionally switch and break statements may be mentioned.

UNIT III

Iterations and Subprograms: Concept of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned.

One dimensional arrays and example of iterative programs using arrays, 2-d arrays Use in matrix computations. Concept of Sub-programming, functions Example of functions. Argument passing mainly for the simple variables.

UNIT IV

Digital: Binary representation of decimal number, Octal and Hexadecimal representation, BCD, Signed and Unsigned representation, One's and two's complement, Boolean Algebra, De-Morgan;s Law, Logic Gates etc.

TEXT BOOKS:

1. Yashwant Kanetkar, "Let us C", BPB Publications.
2. Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill.
3. Rajaraman, "Fundamentals of Computers", Prentice Hall of India.
4. Morris Mano, Digital Design, Pearson's publications.

REFERENCE BOOKS:

1. Kernighan & Ritchie, "C Programming Language", the (ANSI C Version), Printice Hall of India.
2. J. B. Dixit, Fundamental of Computers and Programming in C, Laxmi Publications, New Delhi.

BSCH 125 ENVIRONMENTAL STUDIES (Credits-3)

Course Objectives:

This course in environmental studies will develop the

- Basic understanding about the concept related to the environment such as eco system and biodiversity.
- Understanding pollution and its control.
- Insight about the various concerns regarding environment such as population and social issues.

UNIT-I

Introduction of Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Natural Resources: Renewable and Non-renewable Resources

Land resources: land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT-II

Ecosystems: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.
Case studies of the following ecosystems:

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological Diversity: Levels of biological diversity; genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots; India as

a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT-III

Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Environmental Policies and Practices: Climate change, global warming, ozone layer depletion,
acid rain and impacts on human communities and agriculture.

Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection

Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. International agreements: Montreal &Koyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wildlife conflicts in Indian context.

UNIT-IV

Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides;

Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Field work:

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

TEXTBOOKS:

- ErachBharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India
- Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International, New Delhi.

REFERENCE BOOKS:

- A.K. De, Environmental Chemistry, New Age International, New Delhi.
- P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.
- J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.

BSCS 157 C PROGRAMMING LAB (Credits-1)

List of Experiments

- Write a program to find the largest number out of five numbers (ternary operator)
- Write a program to find roots of quadratic equation using functions.
- Write a C program to check whether a given year is leap year or not.
- Write a C program to check whether a given number is prime or not, also check whether it is divisible by a number k or not.
- Write a C program to take marks of a student as input and print the his/her grade bases on following criteria using if —else statements

  Marks <40 Fail
  40<= Marks <59 Good
  59 <= Marks < 80 Excellent 80 <= Marks Outstanding
- Perform experiment 7 using switch case statement.
- Write a C program to concatenate two strings.
- Write a program using arrays to find the largest and second largest number out of given 10 numbers using bubble sort.

- Write a program to multiply two matrices
- Write a program to reverse a string.
- Write a program to concatenate two strings
- Write a program to calculate the length of the string.
- Write a program to find factorial of a number using function. Note: - Any 10 experiments will be performed.

BSEL 171 COMMUNICATION SKILLS LAB (Credits-1)

Course Objectives:

The Communication Skills Lab focuses on communication activities in functional and situational contexts. It encourages students to speak with fluency and accuracy as well as to enhance the four language skills of reading, writing, listening, and speaking through real life and professional situations.

In each practical class student should spend

- 5 to 10 minutes on effective browsing of online News paper
- 5 to 10 minutes on English Language software activities

Each student must actively complete the following ten activities in practical classes, and the Lab Record with the teacher's signature and the internal marks should be submitted to the External Expert during Viva.

Activity 1: Self - introduction: Informal introduction & formal introduction; A detailed write up on formal 'Self Introduction'; Formal Introduction of oneself in front of the group.

Activity 2: News Reading: Introduction to 'online News papers'; Browsing and selecting the preferred Newspaper; Browsing through the News Headlines; Selecting interested News items; Comprehending the content, writing down the essence and reading the News in front of the Group. Discuss 5 to 8 new words or terms, 4 to 5 important personalities of that day's news etc.

Activity 3: a. JAM: Introduction to 'Just A Minute speech' and the 'Extempore speech'; Preparation of speech on given topic (different topic for each student); delivery of the speech; Feedback (on content, time management, body language etc. highlighting the positive aspects first.)

b. Listening Comprehension: Listen to online / downloaded oration by renowned Orators; write down the content in a precise form and give an oral presentation of that write up following all the etiquettes of public spea

king.

Activity 4: a. Turn Coat: Speaking for and against by the same person with time specification; assign topics from the immediate surroundings; write down the content either from the Net or from personal knowledge; prepare well and deliver; feedback & suggestions for improvement.

b. News Discussions: Selecting News of the day, discussing among the group, prepare the news content and prepare the group opinion about the issue and present it in front of the class

by the group involving each member; select 5 new words & new usages from the selected news item.

Activity 5: Conversation ability: Characteristics of effective conversation; Listening to a few sample conversations; preparing conversation based on the given situation; enacting the situation through effective delivery of the script; feedback & suggestions for improvement.

Activity 6: Role Play: Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement.

Activity 7: Public Speaking: Characteristics of effective public speaking; possible barriers; watching demo online; topic assignment, information gathering & recording; delivery in front of the class; feedback & suggestions for improvement. (Different topic for each student)

Activity 8: Group Discussion: Importance and characteristics; Dos & Don'ts in GD; Demo display; assign topic for the group, Preparation & performance; feedback & suggestions for improvement.

Activity 9: Debate: Difference between Group Discussion & Debating; Watching demo of Debating; Topic for the group of 2 or 4; preparation and performance; feedback & suggestions for improvement.

Activity 10: Interview: Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.

TEXTBOOK:

- Kumar, Sanjay and Pushplata. Communication Skills. Oxford University Press.

REFERENCE BOOKS:

- Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.
- Raman Meenakshi& Sharma, Sangeetha. Technical Communication Principles and Practices, 2nd Ed. Oxford University Press, New Dehi, 2011.

BSMA 131 DATA PRESENTATION FOR SCIENCES (Credits-1)

Using Excel, create documents that highlight:

- Scaling in size. Rounding numbers.
- Graphing simple data. Bar graphs (2D and 3D). Pie Charts.
- Absolute and Relative references. Effects on data visualizations when references aren't properly used.
- Using Functions. SUM, AVERAGE, MEDIAN, SQRT, and other simple one variable functions.
- Using Conditional statements. IF, AND, OR.
- Creating Scatterplots. Showing correlation and regression for two variables, and higher

number of variables.

- Using Filters. Pivot tables. Freezing panes.
- Linking sheets using VLOOKUP and HLOOKUP.

Using PowerPoint, create presentations that highlight:

- Standard format, font, transitions (illustrating negatives of too many variations).
- Using Presenter view in Powerpoint. Multiple notes to be displayed.
- Embedding a functioning Excel sheet into a PowerPoint slide.
- Embedding your own videos, videos from the internet (such as from YouTube), and embedding GIFs.
- Mathematics Formulae in PowerPoint.
- Creating personalized templates.
- Animations and creating animated GIFS using PowerPoint.

BSEL 217

PERSONALITY DEVELOPMENT AND COMMUNICATION SKILLS (Credits 3)

Course Objective: The course will include intensive reading, writing, and some listening practices. Special emphasis will be given on writing correct sentences, guided writing, guessing word meaning in context, understanding long sentences, understanding main idea and also the gist and details of a reading text.

UNIT I

Remedial Grammar: Errors of Accidence and syntax with reference to parts of speech; Confusion of adjectives and adverbs; Agreement of subject and verb; Simple, Complex and Compound Sentences; Question tags and short responses; Sentence Errors

UNIT II

Vocabulary and Usage: One word substitution; Indianism; Redundant words; Jumbled Sentences; Idiomatic Expressions; Framing sentences using words, phrases, idioms etc.

UNIT III

Reading Skills: Introduction to Reading habit; Types of reading: fast and slow Reading; Skimming and Scanning; Loud & Silent Reading; Reading with a purpose; Reading between the lines; Overcoming common obstacles in reading; Comprehension of unseen passages; Summarising.

UNIT IV

Literature

The Chimney Sweeper by William Blake

Mending Wall by Robert Frost

Of Death by Francis Bacon

The Diamond Necklace by Guy De Maupassant

The Grief by Anton Chekhov

TEXTBOOK:

Raman Meenakshi & Sharma, Sangeetha. Technical Communication Principles and Practices, 2nd Ed. Oxford University Press, New Dehi, 2011

REFERENCE BOOKS:

Sinha, K.K. Business Communication. Galgotia Publishers.

Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. Intermediate Grammar, Usage and Composition. Orient Blackswan.

http://100.best-poems.net/ https://www.google.co.in/?gfe_rd=cr HYPERLINK "https://www.google.co.in/?gfe_rd=cr&ei=F-ORV5OhGYrC8geTgp_ABA&gws_rd=ssl"& HYPERLINK "https://www.google.co.in/?gfe_rd=cr&ei=F-ORV5OhGYrC8geTgp_ABA&gws_rd=ssl"ei=F-ORV5OhGYrC8geTgp_ABA HYPERLINK "https://www.google.co.in/?gfe_rd=cr&ei=F-ORV5OhGYrC8geTgp_ABA&gws_rd=ssl"& HYPERLINK "https://www.google.co.in/?gfe_rd=cr&ei=F-ORV5OhGYrC8geTgp_ABA&gws_rd=ssl"gws_rd=ssl#q=short+story+from+english+literature

- **Syllabi of Common Courses in B.Sc. (Hons.) Chemistry and Physics**

BSMA 141 MATHEMATICS —I (Credits-4)

Course Objectives: The subject matter incorporated in this course will enable students to

- Acquire knowledge regarding differential equations and numerical analysis.
- Understand the fields of matrix, differential calculus and integral calculus.

UNIT-I

Recapitulation: Fundamentals, Mathematical functions, polynomial expressions, logarithmic and exponential function, Trigonometric functions, equation of a straight line, plotting graphs. Mathematical series: Power series, Maclaurin, Taylor series.

Numerical Methods: Roots of quadratic equations analytically and iteratively; Numerical methods of finding roots (Bisection, Regular-Falsi, Secant, Newton-Raphson).

UNIT-II

Differential calculus: limiting values of functions: L' Hôspital's rule, the tangent line and the derivative of a function, numerical differentiation, higher order derivatives, maximum-minimum problems, inflexion points.

UNIT-III

Integral calculus: The process of integration, odd and even functions, indefinite integrals, methods of integration, numerical integration.

UNIT-IV

Calculus with several independent variables: Functions of several independent variables, change of variables, relations between partial derivatives, total differentials, and chain rules for partial different ion, Euler's theorem.

TEXTBOOK:

1. H. K. Dass, Higher Engg. Mathematics, S. Chand.

REFERENCE BOOKS:

- M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engg. Computation, New age International, New Delhi.
- Shanti Narayan, Integral calculus, Sultan Chand & Co., New Delhi.
- Shanti Narayan, Differential calculus Sultan Chand & Co., New Delhi.

- **Syllabi of Common Courses in B.Sc. (Hons.) Chemistry and Mathematics**

BSPH 120 PHYSICS-I (Credits-4)

Course Objectives:

The objective of the course module is to

- Introduce basics of particle dynamics
- Understand the concepts of wave optics

UNIT-I

Mathematical Physics: Scalar and vector products, polar and axial vectors, triple and quadruple products. Scalar and vector fields, differentiation of a vector, gradient, divergence, curl and operations and their meaning, idea of line, surface and volume integrals, Gauss and Stokes 'theorem.

UNIT-II

Classical Mechanics: Particle dynamics: Newton's laws of motion, conservation of linear momentum, centre of mass, conservative forces, work energy theorem, particle collision.

Oscillations: Linearity and superposition principle, free oscillation with one and two degrees of freedom, simple pendulum, combination of two simple harmonic motions.

UNIT-III

Wave Optics: Interference, division of amplitudes, Young's double split, Fresnel's biprism, interference in thin films and wedged shaped films, Newton's Rings, Michelson's interferometer.

UNIT-IV

Diffraction: Fresnel &Fraunhofer diffraction: Diffraction at a single slit and N slits, resolving power of a telescope, resolving and dispersive power of a plane diffraction grating.

Polarization: Polarization by reflection and refraction, Brewster's law, double refraction, nicol prism, quarter and half-wave plates, Production, and analysis of circularly and elliptically polarized light.

TEXTBOOK:

1. M. N. Avadhanulu & P. G. Kshirsagar, A Text Book of Engg. physics, S. Chand.

REFERENCE BOOKS:

- H. K. Dass & R. Verma, Higher Mathematical Physics, S. Chand.
- D. S. Mathur, Mechanics, S. Chand.
- M. R. Spiegel, Vector Analysis Schaum's Outline Series. McGraw-Hill Book Co.: Singapore.
- Beiser, Concepts of Modern Physics McGraw-Hill Education, New Delhi.

- R. Resnick, D. Halliday& K.S. Krane, Physics Vol. I and II, John Wiley & Sons, New York, USA.
- R. A. Serway& J. W. Jewett, Physics for Scientists and Engineers, Boston, USA.
- S. L. Gupta, Engg. Physics, DhanpatRai Publications, Delhi.

BSPH 158 PHYSICS —I LAB (Credits-1)

List of Experiments

- To plot a graph between the distance of the knife edge from the centre of gravity and the time period of the bar pendulum. From the graph, find the acceleration due to gravity, the radius of gyration and the moment of inertia of the bar about an axis.
- To determine the moment of inertia of a flywheel about its own axis of motion.
- To determine the value of acceleration due to gravity using Kater‘s pendulum.
- To determine the frequency of A.C. mains with sonometer using non-magnetic wire.
- To determine the frequency of electrically maintained turning fork by Melde‘s method.
- To determine the wavelength of sodium light using Newton‘s ring apparatus.
- To determine the wavelength of prominent lines of mercury by plane diffraction grating.
- To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer.
- To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
- To determine the wavelength of He-Ne LASER using transmission diffraction grating. (Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOK:

1. C. L. Arora, B. Sc. Practical Physics, S Chand and Co. Ltd., New Delhi.

- **Syllabi of Courses specific to B.Sc. (Hons.) Chemistry**

BSCH 111 INORGANIC CHEMISTRY-I (Credits-4)

Course Objectives: Study of the topics included in this course will enable the students to

- Build a basic knowledge about the structure of atom.
- Appreciate the developments in the field of chemical bonding.
- Learn structure and shapes of various homonuclear and heteronuclear molecules.

UNIT -I

Atomic structure -1: The Rutherford model of the atom; Photoelectric effect; Bohr's theory and its limitations; Atomic spectrum of hydrogen atom; The dual nature of electron; De-Broglie equation; Heisenberg's uncertainty principle; Schrodinger's wave equation and its significance.

UNIT- II

Atomic structure-II: Quantum numbers and their significance; Probability distribution curves; Shapes of s, p, d and f orbitals; The sequences of energy levels; Pauli's exclusion principle; Hund's rule of maximum spin multiplicity; Aufbau's principle and its limitations; Change of orbital energy with atomic number; Concept of hybridization.

UNIT- III

Chemical bonding-I: Electronegativity and polarity of bond; Different scales and methods of determination of electronegativity; Variation of electronegativity along a period and a group; Polarities of bonds and molecules; Dipole moments; Ionic bond: Factors affecting the stability of ionic compounds; Lattice energy; Born Lande equation and its applications; Madelungconstant; Born-Haber cycle and its applications; Covalent character in ionic compounds; Polarization and polarizability; Fajan's rules; Factors affecting the ionic radii .

UNIT- IV

Chemical bonding-II : Valence bond Theory (VBT); Resonance structures; Bond angles and shapes of molecules and ions (containing bond pairs and lone pairs); Criterion of bond strength and bond length; Molecular orbitals Theory (MOT) and linear combination of atomic orbitals (LCAO Method); Symmetry and overlap; Bonding in homonuclear molecules (H2 to Ne2) and heteronuclear molecules NO, CO, CN+, CO+, CN-, HF, HCl, BeH2, CO2; Comparison of VB and MO theories.

TEXTBOOKS:

- J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman and Hall Ltd, London.
- W. U. Malik, R. D. Madan, G. D. Tuli, Selected Topics in Inorganic Chemistry, S. Chand and Co. Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

- R. D. Madan, Modern Inorganic Chemistry, S. Chand & Co., New Delhi.
- B. R. Puri, L. R. Sharma and K. C Kalia , Principles of Inorganic Chemistry, S. Chand & Co., New Delhi.

BSCH 113 ORGANIC CHEMISTRY —I (Credits-4)

Course Objectives:

The topics included in this course will help students to

- Understand basic concepts involved in organic reactions.
- Learn classification and nomenclature of organic compounds.
- Appreciate the concept of geometric and optical isomerism.
- Acquire knowledge about the methods of synthesis and reactions of alkanes, alkenes, alkynes and cycloalkanes.

UNIT- I

Basics of organic chemistry (Organic compounds): Classification and nomenclature; Hybridization and shapes of molecules; Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electrometic, resonance and mesomeric effects, hyper conjugation and its applications; Dipole moment; Organic acids and **13** bases and their relative strengths.

Homolytic and heterolytic fission with suitable examples; Curly arrow rules and formal charges; Electrophiles and nucleophiles; Nucleophlicity and basicity; Types, shape and the relative stability of carbocations, carbanions, free radicals and carbenes; Introduction to various types of organic reactions and their mechanism: Addition, elimination and substitution reactions.

UNIT -II

Stereo chemistry: Fischer projection, Newman and Sawhorse projection formulae and their interconversions; Geometrical isomerism: cis-trans and syn-anti isomerism, E/Z notations with C.I.P rules.

Optical Isomerism: Optical activity, specific rotation, chirality/asymmetry and enantiomers; Molecules with two or more chiral-centers; Distereoisomers and meso structures; racemic mixture and resolution, Relative and absolute configuration: D/L and R/S designations.

UNIT- III

Chemistry of aliphatic hydrocarbons: Chemistry of alkanes: Formation of alkanes; Wurtz Reaction and Wurtz- Fitting reactions; Free radical substitutions: Halogenation - relative reactivity and selectivity; Formation of alkenes and alkynes by elimination reactions; Mechanism of E1, E2, E1cb reactions; Saytzeff and Hoffmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition); Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation); 1, 2- and 1, 4- addition reactions in conjugated dienes and Diels-Alder reaction; Allylic and benzylicbromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Preparation, physical properties and reactions of alkynes: Acidity, electrophilic and nucleophilic additions; Hydration to form carbonyl compounds; Alkylation of terminal alkynes.

UNIT- IV

Cycloalkanes and aromatic hydrocarbons: Cycloalkanes: Nomenclature, methods of synthesis and chemical reactions; Baeyer's strain theory and its limitations; Ring strain in small rings (cyclopropane and cyclobutane); Sachse-Mohr concept of strainless rings.

Aromaticity: Hackle's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples; Electrophilic aromatic substitution: Halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism and directing effects of the groups.

TEXTBOOK:

1. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand & Co., New Delhi.

REFERENCE BOOKS:

- R. N. Morrison and R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- I. L. Finar, Organic Chemistry (Volume 1: The Fundamental Principles), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- I. L. Finar, Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- E. L. Eliel, and S. H. Wilen, Stereochemistry of Organic Compounds, Wiley, London.
- S. M. Mukerji, S. P. Singh and R. P. Kapoor, Organic Chemistry Vol. I/II, Wiley Eastern Ltd. New Delhi.

BSCH 117 PHYSICAL CHEMISTRY — I (Credits-4)

Course Objectives:

The subject matter incorporated in this course will enable students to

- Understand the basic concepts of kinetic molecular model of a gas and behavior of real gases.
- Acquire knowledge about the physical properties of liquids.
- Understand the nature and structure of solids.

UNIT- I

Ideal gases: Kinetic molecular theory of gases: Postulates and derivation of the kinetic gas equation; Collision frequency, Collision diameter, Mean free path; Viscosity of gases and their dependence on temperature and pressure; Relation between mean free path and coefficient of viscosity. Maxwell distribution of molecular velocities and molecular energies; Types of molecular velocities (average, root mean square and most probable) and average kinetic energy; Degrees of freedom of a gaseous molecule; Principle of equipartition of energy.

UNIT -II

Real gases: Deviations of real gases from ideal gas behavior; Explanation of deviation; Compressibility factor, Z and its variation with pressure for different gases; Van der Waals equation of state: Derivation and application in explaining real gas behavior; The Viral equation of state; Van der Waals equation expressed in viral form and calculation of Boyle temperature; Isotherms of real gases and their comparison with van der waal isotherms, Continuity of states; Critical state; Relation between critical constants and van der Waal constants; The principle of corresponding states.

UNIT -III

Liquid state: The gaseous, liquid and solid states; Qualitative treatment of the structure of the liquid state; Radial distribution function; Physical properties of liquids: Vapour pressure, surface tension, coefficient of viscosity and their determination; Effect of addition of various solutes on surface tension and viscosity; Cleansing action of detergents; Effect of temperature on viscosity of liquids and comparison with that of gases; Qualitative discussion on structure of water.

UNIT- IV

Solid state: Nature of the solid state; Law of constancy of interfacial angles; Law of rational indices; Miller indices; Symmetry elements and symmetry operations; Point groups and space groups; Space lattice and UNIT cell; Seven crystal system and fourteen Bravais lattices; X-ray diffraction: The Bragg'sequation; A simple account of rotating crystal method and powder pattern method; Idea about super conductivity and liquid crystals.

TEXTBOOK:

1. K. L. Kapoor, A Textbook of Physical Chemistry (Vol. I), Macmillan Publishers India Ltd., Noida.

REFERENCE BOOKS:

- P. W. Atkins and J. de Paula, Atkin's Physical Chemistry, Oxford University Press, London.
- G. W. Castellan, Physical Chemistry, Narosa Publishing House, New Delhi. A. S. Negi
- A. S. Negi, S. C. Anand, A Textbook of Physical Chemistry, New Age International (p) Ltd.

BSCH 151 INORGANIC CHEMISTRY —I LAB (Credits-1)

List of Experiments

- Calibration and use of apparatus.
- Preparation of solutions of different Molarity/Normality of titrants.
- Preparation of standard hydrochloric acid and sodium hydroxide solution.
- Standardization of $KMnO_4$ using sodium oxalate.
- Determination of strength of carbonate and hydroxide present in a given sample using N/10 HCl solution. Determination of strength of carbonate and bicarbonate present in a given sample using N/10 HCl solution.
- Determination of the amount of oxalic acid and sulphuric acid ina given sample using N/10 NaOH and N/10 $KMNO_4$ solution.
- Determination of strength of given solution of ferrous ammonium sulfate (mohr's salt) by using N/30 KMNO4 solution.

8 To Estimate Fe and Fe in a given sample by using N/10 $KMNO_4$ solution.

- To Estimate Fe(II) and oxalic acid using standardized $KMnO_4$ solution
- To Estimate oxalic acid and sodium oxalate in a given mixture.
- To Estimate Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine) and (anthranilic acid) external indicator.
- Determination of strength of given solution of ammonium thiocyanate by volhard method by using N/50 silver nitrate solution.
- Determination of strength of given $AgNO_3$ solution by using N/20 NaCl solution (mohr's method) and K2Cr2O4 as an indicator.

(Note: A candidate must perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOK:

1. O. P Pandey, D.N. Bajpai and S. Giri, Practical chemistry, S. Chand & Company Pvt. Ltd.

REFERENCE BOOK:

1. A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS.

BSCH 153 ORGANIC CHEMISTRY —I LAB (Credits-1)

List of Experiments

- Checking the calibration of the thermometer.
- Purification of organic compounds by crystallization using different solvents (water and ethyl alcohol).
- Determination of the melting points of unknown organic compounds Kjeldahl method and electrically heated melting point apparatus).
- Effect of impurities on the melting point - mixed melting point of two unknown organic compounds.
- Determination of boiling point of liquid compounds (boiling point lower than and more than 100° C by distillation method).
- Chromatography:
  - Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
  - Separation of a mixture of two sugars by ascending paper chromatography
  - Separation of a mixture of o- and p-nitrophenol or o- and p-aminophenol by thin layer chromatography (TLC).
- Preparation of derivatives (urea oxalate)
- Organic Preparations (m-Dinitrobenzene, Picric acid, Oxalic acid).
- Preparation of urea-formaldehyde and phenol formaldehyde resins.
- Determination of saponification number of oils.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

- O. P. Pandey, D. N. Bajpai & S. Giri, Practical Chemistry, S. Chand.
- Sonia Rathani & Srinivas Gurjar, Experimental Organic Chemistry, PHI Learning, Pvt., New Delhi.

REFERENCE BOOKS:

- W. G. Palmer, Experimental Inorganic Chemistry, Cambridge University press, London.
- B. S Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogels Textbook of Practical Organic Chemistry, ELBS with Longman, Longman Singapore Publishers Pte Ltd, Singapore.
- F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.
- G. H. Jeffery, J. Bassett, J. Mendham & R.C. Denney, Vogel's A Textbook of Quantitative Chemical Analysis. John Wiley & Sons, New York.

BSCH 155 PHYSICAL CHEMISTRY —I LAB (Credit-1)

List of Experiments

- Determine the surface tension of given sample by drop number method
- Determine the surface tension of given sample by drop weight method.
- Determine the surface tension of methyl alcohol, ethyl alcohol and n-hexane and also calculate the atomic parachors of C, H and O.
- Study the composition of a given mixture of two miscible liquids by viscosity measurement.
- Viscosity measurement using Ostwald's viscometer.
- Study the effect of the addition of solutes such as (i) polymer (ii) ethanol (iii) sodium chloride on the viscosity of water at room temperature.
- Study the effect of variation of viscosity of an aqueous solution with the concentration of solute.
- Measurement of pH of different solutions using pH-meter.
- Preparation of buffer solutions and comparison of the pH values with the theoretical values.
- To find the cell constant of the conductivity cell.
- To find out the strength of strong/ weak acid conductometric ally.
- To find out the strength of given acid pH-metrically.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOK:

1. B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

REFERENCE BOOKS:

- B. P. Levitt, Findlays Practical Physical Chemistry, Longman Group Ltd., London.
- R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSCH 112 INORGANIC CHEMISTRY-II (Credits-4)

Course Objectives:

The subject matter assimilated in this course

- Acquaints students with the long form of periodic table and classification of elements into four blocks.
- Provides explanation regarding unique position of hydrogen in the periodic table and chemistry of hydrides.
- Emphasizes on the properties of s and p block elements along with the knowledge about generalized acid-base concept.

UNIT- I

The periodic classification of elements and periodic properties: The relationship between chemical periodicity and electronic structure of the atom; The long form of the periodic table; Trends among representative elements; Atomic volume; Atomic and ionic radii; Periodic trends in atomic and ionic radii; Metallic/non-metallic character; standard electrode potential; Periodic trends in electrode potential; Ionization potential; Electron affinity and electronegativity; Electronegativity scale; Bond

energies; Oxidation numbers and oxidation states; Periodicity in oxidation state of valence; Oxidizing or reducing behaviour; Acidic and basic character of oxides. Hydrogen and acids-bases: Unique position of hydrogen in the periodic table; Isotopes of hydrogen; Industrial production; Hydrides and their chemistry; Heavy water; Hydrogen bonding; Hydrates.

UNIT- II

The s-block elements: Production and uses of metals; Chemical reactivity and trends in alkali and alkaline earth metals; Structure and properties of oxides, halides and hydroxides; Anomalous behavior of lithium and its similarity with magnesium; Anomalous behavior of beryllium; Diagonal relationship of beryllium and aluminum; Coordination complexes; Organometallic compounds of alkali metals; Crown and crypts; Behavior of solutions in liquid ammonia.

UNIT -III

The p-block elements group III and IV (B, Al, Ga, In, Th family): Chemical reactivity and trends; Structures of crystalline boron; Crystal structures of borides, boranes and carboranes; Metallocarboranes and their chemistry; Boron halides; Boric acid; Borates; Boron- nitrogen compounds; $LiAlH_4$ —its uses as a reducing and hydrogenating reagent. C, Si, Ge, Sn, Pb family: Chemical reactivity and group trends; Carbon: Allotropic forms, compounds; Graphite intercalation compounds; Carbides.

UNIT- IV

Acids and Bases: Various concepts of acids and bases; Relative strength of acids and bases; Amphiprotic substances; The solvent system concept of acid and bases; Lewis acid-base concept; Bond energies; Classification of lewis acids and bases; The Usanowich concept of acid and bases and its applications; Pearson's hard and soft acid (HSAB) concept; Acid-base strength and hardness and softness; Symbiosis; Theoretical basis of hardness and softness; Electronegativity and hardness and softness.

TEXTBOOK:

1. B.R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, S. Chand & Co., New Delhi.

REFERENCE BOOKS:

- J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman & Hall Ltd., London.
- W. U. Malik, R. D. Madan, G. D. Tuli, Selected Topics in Inorganic Chemistry, S. Chand & Company Pvt. Ltd., New Delhi.
- F. A. Cotton, G. W. Wilkinson and P. L. Gaus, Basic Inorganic Chemistry, John Wiley and Sons, New York.
- J. E. Huheey, E. A. Keiter, R. L. Keiter, Inorganic Chemistry: Principles of Structures and Reactivity; Harper Collins College Publishers, New York.
- Modern Inorganic chemistry, S. Chand & Company Pvt. Ltd., New Delhi

BSCH 114 ORGANIC CHEMISTRY-II (Credits-4)

Course Objectives:

The subject matter incorporated in this course will help students to

- Understand structure, stability, methods of synthesis and reactions of arenes and aryl halides.
- Know about aliphatic and aromatic alcohols, their acidic strength and chemical properties.
- Learn nomenclature and reactions of ethers and epoxides.

UNIT- I

Alkyl and Aryl halides: Nomenclature, methods of preparation and chemical reactions of alkyl halides; Mechanisms of nucleophilic substitution with stereochemical aspects, kinetics and effect of solvent etc.; nucleophilic substitution vs elimination; Preparation and properties of chloroform, carbon tetrachloride.

Nomenclature of benzene derivatives; The aryl group; Aromatic nucleus and side chain; Activating and deactivating substituents: Orientation and ortho/para ratio. Side chain reactions of benzene derivatives: Birch reduction; Methods of formation and chemical reactions of alkylbenzenes.

Structure and methods of preparation of aryl halides; Nuclear and side chain reactions; The addition-elimination and the elimination-addition reactions; Mechanisms of nucleophilic aromatic substitution reactions; Relative reactivities of alkyl halides vs. allyl, vinyl and aryl halides; Synthesis and uses of DDT and BHC.

UNIT II

Alcohols: Classification and nomenclature of alcohols; Nomenclature and methods of formation (reduction of carbonyl compounds, carboxylic acids and esters) of monohydric alcohols; Hydrogen bonding in alcohols; Acidic nature of alcohols and their reactions; Manufacture of ethyl alcohol from molasses.

Dihydric alcohols: Nomenclature, methods of preparation and chemical reactions of vicinal glycols;
Pinacol-pinacolone rearrangement.

Trihydric alcohols: Nomenclature, methods of formation and chemical reactions of glycerol.

UNIT III

Phenols: Nomenclature, structure and bonding; Preparative methods of phenols; Physical properties and acidic character; Comparison between acidic strengths of alcohols and phenols; Resonance stability of phenoxide ion. Electrophilic aromatic substitution; acylation and carboxylation reactions of phenols

Mechanisms of Fries rearrangement; Claisen rearrangement; Gatterman synthesis; Hauben-Hoesch reaction, Ledrer-Manasse reaction and Reimer-Tiemann reaction

UNIT -IV

Ethers and epoxides: Nomenclature, isomerism, methods of synthesis, physical and chemical properties of ethers. Synthesis of epoxides; Acid and base-catalyzed ring opening of epoxides; Orientation of epoxide ring opening, Organometallic compounds of Mg and Li and their use in synthesis of organic compounds; Reactions of Grignard and Organolithium reagents with epoxides

TEXTBOOK:

1. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand & Co., New Delhi.

REFERENCE BOOKS:

- R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., New Delhi.
- I. L. Finar, Organic Chemistry (Volume 1) The Fundamental Principles, The English LanguageBook Society & Longman Group Limited, London.

BSCH 118 PHYSICAL CHEMISTRY-II (Credits-4)

Course Objectives:

The subject matter incorporated in this course will help students to

- Learn about the various laws and conditions which govern the behaviour of gases and solutions and the phases in which they exist under different conditions.
- Understand concept of chemical potential and its application in deriving different colligative

properties.

- Appreciate concept of entropy and spontaneous processes.

UNIT - I

Chemical thermodynamics-I: Isolated, closed and open systems; Thermodynamic equilibrium; Intensive and extensive variables; State and path functions; Zeroth law of thermodynamics.

Concept of heat q, work w, internal energy U, enthalpy H and statement of first law; Relation between heat capacities; Calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Heats of reactions; standard states; Enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data; Effect of temperature (Kirchoff's equations) and pressure on enthalpy of reactions; Adiabatic flame temperature and explosion temperature.

UNIT- II

Chemical thermodynamics-II: Limitation of 1st law; spontaneous processes; Carnot cycle; Statement of the second law of thermodynamics; Concept of entropy and its physical significance; Calculation of entropy change for reversible and irreversible processes.

The Nernst heat theorem; Third law of thermodynamics; Determination of absolute entropy of molecules; residual entropy; Gibbs (G) and Helmholtz energy(A); variation of S, G, A with T, V, P; Free energy change and spontaneity; Relation between Joule-Thomson coefficient and other thermodynamic parameters; Inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; Thermodynamic equation of state.

UNIT- III

Systems of variable composition: Partial molar quantities; Dependence of thermodynamic parameters on composition; Gibbs - Duhem equation; Variation of chemical potential with temperature and pressure; chemical potential in a system of ideal gases; Concept of fugacity and activity; Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient; Exoergic and endoergic reactions.

UNIT- IV

Chemical equilibrium: Criteria of thermodynamic equilibrium; Degree of advancement of reaction; Chemical equilibria in ideal gases; Equilibrium constants and their quantitative dependence on temperature, pressure and concentration; Free energy of mixing and spontaneity; Thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx; Equilibrium constants for reactions involving real gases; Le Chatelier principle.

TEXTBOOKS:

- B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company.
- Arun Bahl, Essentials of Physical Chemistry, S. Chand Publishing

REFERENCE BOOKS:

- P. W. Atkins and J. de Paula, Atkin's Physical Chemistry, Oxford University Press, Oxford.
- G. W. Castellan, Physical Chemistry, Narosa Publishing House, New Delhi.
- K. L. Kapoor, A Textbook of Physical Chemistry (Vol. I), Macmillan Publishers India Ltd.
- S. Negi and S. C. Anand, A Textbook of Physical Chemistry, New Age International (P) Ltd.

BSCH 152 INORGANIC CHEMISTRY –II LAB (Credit-1)

List of Experiments

Iodo/IodimetricTitrations

- Estimation of Cu (II) and K2Cr2 O7 using sodium thiosulphate solution (Iodimetrically)
- Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically
- Estimation of available chlorine in bleaching powder iodometrically.

Inorganicpreparations

- Cuprous Chloride, Cu2Cl2
- Preparation of Manganese (III) phosphate, MnPO4.H2O
- Preparation of Aluminium Potassium sulphateKAl(SO4)2.12H2O (Potash alum) or Chrome alum.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOK:

1. O. P Pandey, D.N. Bajpai and S. Giri, Practical chemistry, S. Chand & Company Pvt. Ltd.

REFERENCE BOOK:

1. A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS.

BSCH 164 ORGANIC CHEMISTRY –II LAB (Credit-1)

List of Experiments Organic Preparations

- Acetylation of one of the following compounds: amines (aniline, o-,— ,p- toluidinesand o - ,m-,p- anisidine) and phenols (**β**-naphthol, vanillin, salicylic acid).
- Benzolyation of one of the following compounds: amines (aniline, o-,m-,p- toluidinesand o- ,m-,p- anisidine) and phenols (**β**-naphthol, resorcinol, p- cresol) by Schotten-Baumann reaction.
- Hydrolysis of amides and esters to obtain benzoic acid.
- Derivatives of the carbonylcompounds:
- 2,4-DNP of one the following compounds- acetone, ethyl methyl ketone, di-ethyl ketone, cyclohexanone.
- Semicarbazone of one the following compounds- acetone, ethyl methyl ketone, di- ethyl ketone, cyclohexanone.
- oxime of onethe following compounds- di-ethyl ketone, cyclohexanone.
- Nitration of one the following compounds: nitrobenzene, chlorobenzene, bromobenzene.
- Oxidation of the following compounds: benzaldehyde, benzyl alcohol acetophenone tobenzoic acid (by iodoform reaction).

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

- J. Mendham, R. C Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.
- O.P. Giri, D.N. Bajpai and S.Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

- W. G. Palmer, Experimental Inorganic Chemistry, Cambridge University press, London.
- B. S Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogels Textbook of Practical Organic Chemistry, ELBS with Longman, Longman Singapore Publishers Pte Ltd, Singapore.
- F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

BSCH 156 PHYSICAL CHEMISTRY – II LAB (Credit-1)

List of Experiments

Thermochemistry

- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- Calculation of the enthalpy of ionization of ethanoic acid.
- Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
- Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperatureversus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
- Determination of enthalpy of hydration of copper sulphate.
- Study of the solubility of benzoic acid in water and determination of enthalpy change. (Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOK:

1. B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

REFERENCE BOOKS:

- B. P. Levitt, Findlays Practical Physical Chemistry,Longman Group Ltd., London .
- R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSCH 211 INORGANIC CHEMISTRY –III (Credit-4)

Course objective: The subject matter assimilated in this course

- Acquaints students with the metallic bonding and vander waal's forces of attraction
- Provides explanation regarding chemistry of halogen family.
- Emphasizes on p block elements and their chemical reactivities.

UNIT I

Chemical bonding II:

(I) Metallic Bond: Qualitative idea of valence bond and band theories,Semiconductors and insulators, defects in solids.

(II) Weak Chemical forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

UNIT II

The p-block elements: Alumina and aluminates; Manufacture of portland cement; Organometallic compounds of Aluminium; Silicon carbides, silicides, silanes and silylamines; Structures of silicate mineral; Organosilicon compounds; Oxides and halides of tin and lead; Pb accumulators; Organometallic compounds of Sn and Pb.

The p-block elements VB (N, P, As, Sb and Bi family): Chemical reactivity and group trends; Anomalous behavior of nitrogen; Types of covalence in nitrogen and stereochemistry; Chemical reactivity; Dinitrogen complexes; Hydrides of nitrogen; Liquid NH3 as a solvent; Nitrogen halides; Oxides and oxyacids of nitrogen; Elemental P and its allotropic forms; Hydrides, halides, oxides and oxy-acids of phosphorous; Phosphorus-nitrogen compounds.

UNIT III

The p-block elements VIB (O, S, Se and Te Family) : Chemical Reactivity, group trends and stereochemistry; Dioxygen as a ligand (basic idea only); Structure of O3 and H2O2; Clathrate hydrates; Allotropic forms of S and Se; Structures of halides, oxides and oxyacids of S, Se and Te; Liquid SO2 and sulphuric acid; S-N compounds (neutral) ; Polyatomic cations of S, Se and Te.

UNIT IV

The halogen family : Chemical reactivity and group trends; Chemistry of preparation of fluorine; Hydrogen halides; HF as a solvent; Preparation and structures of inter-halogen compounds; Polyhalide and polyhalonium ions; polyatomic cations of halogens; Oxides and oxyacids of halogens.

TEXTBOOK:

J. D. Lee, Concise Inorganic Chemistry, ELBS.

REFERENCE BOOKS:

1. B. E. Douglas and D.H. Mc Daniel, Concepts & Models of Inorganic Chemistry, Oxford Press.

3. H.W. Porterfield, Inorganic Chemistry, Academic Press. .

4. B. R. Puri, L. R. Sharma and K. C Kalia , Principles of Inorganic Chemistry, Shobhan Lal Nagin Chand & Co., New Delhi.

5. R. L. Madan, Chemistry for degree students-I TO III, S. Chand Publishing.

6. M. C. Day and J. Selbin, Theoritical Inorganic Chemistry, ACS Publications.

BSCH 213 ORGANIC CHEMISTRY -III (Credits 4)

Course objective: The subject matter of this course provides knowledge about

- nomenclature, synthesis, structure, bonding and properties of carbonyl compounds, carboxylic acids and substituted carboxylic acids.
- methods of preparation and important reactions of fat and oils.
- synthesis, structure elucidation and chemistry of acid chlorides, esters, amides (urea) and acid anhydrides.

UNIT I

Aldehydes and ketones : Nomenclature and structure of the carbonyl group; Methods of preparation: Direct oxidation of alcohols and catalytic dehydrogenation of alcohols, Oxidation of alkenes; Hydration of alkynes; Hydrolysis of gem-Dihalides; Pyrolysis of calcium salts of acids; Synthesis of aldehydes from acid chlorides, Synthesis of aldehydes and ketones using 1,3-dithianes, Synthesis of ketones from nitriles and from carboxylic acids; Physical properties; Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, perkin and knoevenagel condensations; Condensation with ammonia and its derivatives; Wittig reaction; Mannich reaction; Oxidation of aldehydes; Baeyer-Villiger oxidation of ketones; Canizzaro reaction; Clemmensen; Wolff-Kishner; Haloform reaction; Reformatsky reaction; LiAIH4 and NaBH4 reductions.

UNIT II

Monocarboxylic acids: Nomenclature, structure and bonding of carboxylic compounds; Physical properties and acidity of carboxylic acids; Effects of substituents on acid strength; Preparation and reactions of aliphatic and aromatic carboxylic acids; Hell-Volhard-Zelinsky reaction; Reduction of carboxylic acids; Mechanism of decarboxylation.

Dicarboxylic acids: Nomenclature, physical properties and methods of formation; Chemical properties: Reactions of -COOH group, effect of heat and dehydrating agents, reactions of oxalic, malonic, succinic and adipic acid.

UNIT III

Halo carboxylic acids: Methods of preparation and properties.

Hydroxy carboxylic acids: Nomenclature, methods of preparation and properties.

Polyhydroxy carboxylic acids: Preparation and properties of malic, tartaric and citric acids.

Methods of synthesis and chemical reactions of unsaturated monocarboxylic acids.

UNIT IV

Acyl derivatives: Orbital structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides; Relative stability of acyl derivatives; Synthesis of acid chlorides, esters and amides; Physical properties; Chemical reactions; Mechanisms of esterification and hydrolysis (acidic and basic).

Fats and oils: Distinction between fats and oils; Extraction; Physical and chemical properties; Analysis of fat and oils; Manufacture of soap; Synthetic detergents.

TEXTBOOKS:

1. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand and Co. Ltd., New Delhi

REFERENCE BOOKS:

1. R. N. Morrison and R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd., (Pearson Education) New Delhi.

2. I. L. Finar, Organic Chemistry (Volume 1The Fundamental Principles), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education) New Delhi.

3. S. M. Mukerji, S. P. Singh and R. P. Kapoor , Organic Chemistry Vol. I/II, Wiley Eastern Ltd., New Delhi.

4. G. Marc Loudon, Organic Chemistry, Oxford University Press, New Delhi.

5. P. Y. Bruice, Organic chemistry, Dorling Kindersley (India) Pvt. Ltd(Pearson Education). New Delhi.

BSCH 215 PHYSICAL CHEMISTRY –III (Credits 4)

Course objective: The subject matter incorporated in this course will enable students to

- understand the basic concepts of electrochemistry.
- Acquire knowledge about the nature and behavior of electrolytes and their ionization.
- Gain understanding about the colligative properties of solutions.

UNIT I

Ionic equilibrium I: 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; dissociation constants of mono-, di- and tri- protic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

UNIT II

Ionic equilibrium II: Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid – base indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.

UNIT III

Electrochemistry: Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb2O3 electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers.

UNIT IV

Solutions and colligative properties: Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications.

Excess thermodynamic functions: Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

TEXTBOOK:

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company.

REFERENCE BOOKS:

1. P. W. Atkins and J.de Paula, Atkin's Physical Chemistry, Oxford University Press. Oxford.

2. G. W. Castellan, Physical Chemistry, Narosa.

3. R.G. Mortimer, Physical Chemistry, Elsevier: Noida, UP.

4. D.A. McQuarrie and J.D. Simon, Molecular Thermodynamics Viva Books Pvt. Ltd., New Delhi.

5. K. L. Kapoor, A Textbook of Physical Chemistry (Vol. I), Macmillan Publishers India Ltd.

BSPH 217 PHYSICS-II (Credits 4)

Course objective: The course incorporated in this paper will help students to

- understand concepts of electricity and magnetism.
- gain insight into the theory of semiconductors.
- knowledge about nuclear fission and fusion.

UNIT I

Electricity & Magnetism: Electric field and potential, potential energy, flux, Gauss's law and its applications, electric field in a dielectric, polarization, energy stored in an electric field, Magnetic properties of matter, Langevin's theory of dia and para magnetism, Weiss theory of ferromagnetism.

UNIT II

Electronics : Semiconductors, types of semi-conductors (qualitative), P-N junction diode, energy band diagram, biasing, I-V characteristics, halfwave, fullwave and bridge rectifiers, ripple factor, rectification efficiency, regulated power supply, Zener diode, Light Emitting Diode (LED), solar cell, Bipolar Junction Transistor (BJT), Configurations (CB,CE and CC), Characteristic curves of transistor static and dynamic load line, Transistor as an amplifier, logic gates, DeMorgan`s theorem, AND, OR, NAND, NOR, XOR, XNOR

UNIT III

Atomic Structure: Bohr's model of one electron atom, Wilson –Sommerfeld quantization rules (derivation of Planck's quantization of energy), Bohr's correspondence principle, orbital magnetic dipole moment, Larmor precession, space quantization, Electron spin , vector model of atom-coupling of orbital and spin angular momentum, spectroscopic terms- L-S and j-j coupling, Lande interval rule, selection rules for L-S and j-j coupling.

UNIT IV

Nuclear Physics: The Atomic Nucleus, Nuclear force, Static properties of nucleus-mass, radius, density charge, quantum states, spin and magnetic moments; Nuclear stability, binding energy, Nuclear models- liquid drop model and shell model; Meson theory of nuclear forces, Radioactivity, Half-life , Alfa, beta and gamma decay, nuclear fission and fusion, Nuclear reactors.

TEXTBOOKS:

S.N. Ghoshal, Nuclear Physics, S. Chand Limited.

M. N. Avadhanulu and P. G. Kshirsagar, A textbook of Engineering Physics, S.Chand.

REFERENCE BOOKS:

Arthur Beiser, Concepts of Modern Physics, McGraw-Hill Company Inc.

Kenneth Krane, Modern Physics, Wiley India.

Albert Paul Malvino, Electronic Principles, McGraw-Hill School Publishing Company.

BSCH 251 INORGANIC CHEMISTRY-III LAB (Credits 1.5)

List of Experiments

(1) Complexometric Titrations:

(i) Complexometric estimation of (i) Mg^{2+} (ii) Zn^{2+} using EDTA

(ii) Estimation of total hardness of water samples

(iii) Estimation of Ca^{2+} in solution by (substitution method) using Erio-chrome black-T as indicator.

(iv) Estimation of Ca/Mg in drugs and Biological samples.

(2) Iodometic Titrations:

(i) Determination of Cu^{2+} (using standard hypo solution).

(3) Argentometry: Estimation of Cl^- (i) By Mohr's method, (ii) By Vohlard's method, (iii) By Fajan's method.

(4) Paper Chromatographic separation of Ni (II) and Co (II); Cu (II) and Cd (II)

(5) To verify Beer - Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/K_2Cr_2O_7$ solution.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. A.I. Vogel, A Textbook of Quantitative Chemical Analysis, ELBS.

2. O. P Pandey, D.N. Bajpai and S. Giri, Practical chemistry, S. Chand & Company Pvt. Ltd. New Delhi.

Reference Books:

1. H.H. Willard et. al: Instrumental Methods of Analysis, Wordsworth Publishing Company, Belmont, California, USA.

2. V.K Ahluwalia, and Sunita Dhingra, College Practical Chemistry, University Press India Pvt.Ltd.

BSCH 253 ORGANIC CHEMISTRY – III LAB (Credits 1.5)

List of Experiments

Organic Preparations

Diels-Alder reaction between anthracene and maleic anhydride.

Reduction of nitrobenzene to azobenzene (TLC of the mixture), m-dinitrobenzene to m-nitroaniline.

Photochemical reduction of benzophenone to benzopinacol.

Benzoin condensation of benzaldehyde (using thiamine hydrochloride).

Condensation of p-toluidine with benzaldehyde /salicylaldehyde /2-hydroxy-3-methoxy benzadehyde to get schiff's base (solventless condensation).

Estimation of Phenol and aniline by bromination with potassium bromate-potassium bromide method.

Estimation of glycine by formylation method

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. S. Ratnani and S. Gurjar, Experimental Organic Chemistry, PHI Learning Pvt. Ltd., NewDelhi

REFERENCE BOOKS:

1. B. S. Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry , ELBS with Longman, Longman Singapore Publishers Pte Ltd, Singapore.

2. F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

3. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

4. J. Mendham, R. C. Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.

BSCH 255 PHYSICAL CHEMISTRY-III LAB (Credits 1.5)

List of Experiments

1. Study the equilibrium of at least one of the following reactions by the distribution method:

(i) $I_2(aq) + I^- \rightarrow I_3^-(aq)$

(ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$

2. Perform the following potentiometric titrations (at least two):

(i) Strong acid with strong base

(ii) weak acid with strong base and

(iii) dibasic acid with strong base

3. Potentiometric titration of Mohr's salt with potassium dichromate.

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

5. Phase equilibria: Construction of the phase diagram of (i) simple eutectic and (ii) congruently melting systems, using cooling curves and ignition tube methods.

6. To determine the melting point by using melting point apparatus.

7. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.

8. To determine the solubility of benzoic acid at various temperatures and to determine the ΔH of the dissolution process.

9. To study the distribution of iodine between water and CCl_4.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

Reference Books:

1. R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSPH 257 PHYSICS-II LAB (Credits 1.5)

List of Experiments

To find unknown resistance by using Ohm`s law.

To measure high resistance by substitution method.

Study of transistor characteristics (CB, CE, CC configurations).

To verify experimentally OR, NAND, NOT, NOR, NAND gates.

To find the band gap of intrinsic semiconductor using four probe method.

To study of V-I characteristics of p-n junction diode.

To determine the Hystersis loss of ferromagnetic material using CRO.

To study the variation of magnetic field with distance and to find the radius of coils by using Stewart-Gee's apparatus.

Measurement of dielectric constant.

Study of Charging and discharging of a capacitor.

To find the Ionization potential of Xe using thyretron tube.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

C. L.Arora, B. Sc Practical Physics, S Chand and Co. Ltd., New Delhi.

BSCH 212 INORGANIC CHEMISTRY –IV (Credits 4)

Course objective: The subject matter incorporated in this course will help students to

- Understand the chemistry of noble gases.
- crystal defects and their utility in conduction.
- nomenclature, crystal field theory and stability of coordination compounds

UNIT I

Noble gases: Occurrence & uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF2 and XeF4, XeF6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2). Molecular shapes of noble gas compounds (VSEPR theory).

UNIT II

Defects in crystals: Intrinsic and extrinsic defects: Point, line and plane defects; Vacancies: Schottky and Frenkel defects; Thermodynamics of Schottky and Frenkel defect formation; The colourcentres; Imperfactions due to transient atomic displacements; Band structure of metals; Insulators and semiconductors; Intrinsic and extrinsic semiconductors; Doping semiconductors; P-N junctions; High temperature super conductors.

UNIT III

Co-ordination compounds: Various definitions; Classical and non-classical ligands; The Chelate and microcyclic effect; Multidentate ligands; Conformation of chelate rings; Stereochemistry and various coordination numbers; Isomerism in coordination compounds: Nomenclature and stability of coordination compounds: Thermodynamic and kinetic stability; Stability constants and factors affecting the stability constant; Experimental and statistical ratios of stability constants.

UNIT IV

Theories for bonding in complexes: Valence bond theory for bonding in coordination compounds; Concept of multiple bonding and back bonding: Strength and weakness of valence bond approach.

Crystal field theory: Splitting of d-orbitals in different fields; Consequences of orbital splitting; Crystal field stabilization energy; Magnetic properties; Factors affecting extent of splitting and spectrochemical series; Colour of transition metal complexes; Structural effect of crystal field splitting; Ionic radii; Jahn Teller effect in octahedral and tetrahedral complexes; Molecular orbital treatment of octahedral complexes; Molecular orbital diagrams for tetrahedral and square planar complexes.

TEXTBOOKS:

B.R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shobhan Lal Nagin chand & Co., New Delhi.

REFERENCE BOOKS:

F. A.Cotton , G. W. Wilkinson and P. L.Gaus ,Basic Inorganic Chemistry, John Wiley and Sons, New York.

J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman & Hall Ltd, London.

J. E. Huheey, E. A. Keiter, R. L.Keiter, Inorganic Chemistry: Principles of Structures and Reactivity; Harper Collins College Publishers, New York.

R. D. Madan, Modern Inorganic chemistry, S. Chand & Company Pvt. Ltd., New Delhi.

G.L. Miesster, E Donald and A. Tarr, Inorganic Chemistry 4th edition, Pearsons.

A.R. West, Solid state Chemistry and its applications, John Willeys Sons, 1987.

R. C. Aggarwal, Modern Inorganic Chemistry, 1st Edition (1987), Kitab Mahal, Allahabad.

BSCH 214 ORGANIC CHEMISTRY –IV (Credits 4)

Course objective: The subject matter incorporated in this course provides knowledge about

- The chemistry of organo- sulphur, organo- phosphorous compounds.
- Preparation and reactions of amines and heterocyclic compounds.
- Synthesis and applications of dyes and pigments.

UNIT I

Organo-sulphur compounds: Preparation and reactions of thiols, thioethers and aromatic sulphonic acids.

Organo-phosphorous compounds: Methods of formation, physical and chemical reactions of phosphines and phosphine oxides.

Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 10, 20 and 30 amines with Hinsberg reagent and nitrous acid; Preparation and important reactions of nitro alkanes and alkyl nitrites and isonitriles.

Diazoalkanes and Azides: Preparation and their synthetic applications.

UNIT II

Polynuclear Hydrocarbons: Synthesis and reactions of naphthalene, phenanthrene and anthracene; Structure, methods of preparation, structure elucidation and important derivatives of naphthalene and anthracene.

UNIT III

Heterocyclic Compounds: Classification and nomenclature, Structure and aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction.

Derivatives of furan: Furfural and furoic acid.

UNIT IV

Colours dyes and pigments: Wit's theory of color; Modern theory of color; Dyes and their classification according to chemical structure; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes - Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein.

Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Classification according to their methods of application; Food dyes.

TEXTBOOKS:

1. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand and Co. Ltd., New Delhi

Reference Books:

1. R. N. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, New Delhi.

2. I. L. Finar, Organic Chemistry (Volume 1The Fundamental Principles), Pearson Education, New Delhi.

3. S. M. Mukerji, S. P. Singh and R. P. Kapoor, Organic Chemistry Vol. I/II, Wiley Eastern Ltd., New Delhi.

4. G. Marc Loudon, Organic Chemistry, Oxford University Press, New Delhi.

5. P. Y. Bruice, Organic chemistry, Pearson Education, New Delhi.

BSCH 226 PHYSICAL CHEMISTRY –IV (Credits 4)

Course objective:

This course provides students an understanding about the concept of

chemical kinetics and role of catalyst in enhancing the rate of reaction.

surface and colloidal chemistry

study of macromolecules and their kinetics

UNIT I

Chemical kinetics-I: Order and molecularity of a reaction; Rate laws, Differential and integrated form of rate expressions up to second order reactions; Experimental methods of the determination of rate laws; Effect of temperature on reaction rates; Arrhenius equation; Activation energy; Collision theory of bimolecular gaseous reactions; The Lindemann theory of unimolecular gaseous reactions.

UNIT II

Chemical kinetics-II: Kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing or reverse reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions; Types and characteristics of catalyst; Mechanism of acid-base catalysis; The Michelis- Menten's equation for enzyme catalysis; Mechanisms of catalyzed reactions at solid surfaces; Effect of particle size and efficiency of nanoparticles as catalysts; Auto catalysis.

UNIT III

Surface chemistry: Physical and chemical adsorptions; Applications of adsorption; Factors influencing adsorption; Adsorption isotherms; Modern techniques for investigating surfaces.

Colloid chemistry: Classification, preparation and purification of colloidal solution; Properties of colloids: Electrical and electrokinetic properties; Determination of size of colloidal particle; Mechanism of coagulation; Micelles and reverse micelles; Solubilisation.

UNIT IV

Polymeric Biomaterials: Polysaccharides as biomaterials: xanthan, guar gum, chitosan, cellulose; silicones as pharmaceutical and biomedical applications

TEXTBOOKS:

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, Jalandhar.

2. Arun Bahl, Essentials of Physical Chemistry, S. Chand Publishing

REFERENCE BOOKS:

1. P. W. Atkins and J.de Paula, Atkin's Physical Chemistry, Oxford University Press. Oxford.

2. G. W. Castellan, Physical Chemistry, Narosa Publishing House, New Delhi.

3. R.G. Mortimer, Physical Chemistry, Elsevier: Noida, UP.

4. K. L. Kapoor, A textbook of Physical Chemistry (Vol. I), Macmillan Publishers India Ltd., Delhi.

5. Polymeric biomaterials-revised and expanded, Severian Dumitriu, second edition, CRC Press, ISBN: 0-8247-0569-6

BSCH 218 ANALYTICAL CHEMISTRY (Credits 4)

Course objective: Analytical chemistry serves as an important tool to study and elucidate the structure of various chemicals. The topics inducted in this course will help students to

- understand the basic principles involved in thermal methods of analysis.
- get an insight about the principles of instrumentation of flame atomic absorption and emission spectrometry.
- learn about techniques for separation of different mixtures.

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, indeterminate errors, statistical test of data; F, Q, and T test, rejection of data, and confidence intervals.

UNIT II

Thermal and Electro analytical methods: Theory of thermogravimetry (TG), basic principle of instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry(DSC).

Basic principle of pH metric, potentiometric and conductometric titrations; Techniques used for the determination of equivalence point; Techniques used for the determination of pKa values.

UNIT III

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation: Choice of source, monochromator, 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.

UNIT IV

Separation Techniques: Classification and principle and efficiency of the solvent extraction technique. Mechanism of extraction by solvation and chelation, Batch, continuous and counter current extraction techniques.

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.

TEXTBOOKS:

1. B. K. Sharma, Instrumental Methods of Analysis, Goel Publishing House Meerut.

REFERENCE BOOKS:

1. A.I.Vogel, A Test book of Quantitative Inorganic Analysis (Rev. by GH Jeffery and others), The English Language Book Society of Longman.

2. H. H. Willard, et. al: Instrumental Methods of Analysis, Wordsworth Publishing Company, Belmont, California, USA.

3. G.D.Christian, D.Gary , Analytical Chemistry, John Willy, New York.

4. S. M. Khopkar, Basic Concepts of Analytical Chemistry New Age, International Publisher.

5. D. A. SKoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.

BSMA 142 Mathematics – II (Credits 4)

Course objective: The subject matter incorporated in this course will enable students to

- acquire knowledge regarding differential equations.
- understanding in the field of vector algebra.

UNIT I

Exact differential equation, equations reducible to exact differential equations, application of differential equation to Newton's law of cooling and orthogonal trajectories. Linear differential equations of second and higher order. Complete solution, complementary function and particular integral, method of variation of parameter to find particular integral, Cauchy's and Legendre's linear equation , simultaneous linear equations with constant coefficients.

UNIT II

Complex number, geometrical representation of imaginary numbers, argand diagram, Equal complex number, addition of complex numbers, Subtraction, Power of iota, Multiplication, Iota as an operator, Conjugate of complex number, Division, Modulus and argument, Polar form, Type of complex number, Square root of complex number, Exponential and circular functions of complex variables, De-moivre's theorem, Roots of complex number, circular function of complex numbers, Separation of real and imaginary parts of circular functions.

UNIT III

Double integration, Evaluation of double integral, evaluation of double integrals in polar co-ordinates, Change of order of integration, area by double integration, Volume by double integration, Tripple integration,Beta and gamma functions and their relation.

UNIT IV

Determinants. Matrix algebra, Simultaneous equations: method of substitution and elimination, consistency and independence. Homogeneous linear equations. Simultaneous equations with more than two unknowns (e.g. spectrophotometry), Cramer's rule, matrix inversion, orthogonal and UNITary matrices, matrix eigenvalues and eigenvectors, diagonalization of a matrix.

TEXTBOOKS:

1. D.A. McQuarrie, Mathematics for Physical Chemistry, University Science Books.

2. R. Mortimer, Mathematics for Physical Chemistry, 3rd Ed. Elsevier.

3. E. Steiner, The Chemical Maths Book, Oxford University Press.

BSCH 252 INORGANIC CHEMISTRY-IV LAB (Credits 1.5)

List of Experiments

Qualitative analysis:

Using H2S /PTC/ Thioacetamide or any other reagent. Identification of cations and simple anions in a mixture of salts containing not more than six ions (Three cations and three anions)

Cation :Pb2+, Bi3+ Cu2+, Cd2+, As3+, Sb3+, Sn2+ or Sn4+, Fe2+ OR Fe3+, Al3+, Cr3+,Co2+, Ni2+, Zn2+, Mn2+, Ba2+, Sr2+, Ca2+, Mg2+, NH4+, K+

(ii) Anion : CO32-, SO32-, CO23, SO2-3, S2-, NO-2, CH3COO-, NO-3, Cl-, Br-, I-, SO42-, PO43-,BO33-,F-, C2O2-4

Analysis of interfering anions using semi micro scheme of analysis.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

O. P Pandey, D.N. Bajpai, S.Giri, Practical chemistry, S.Chand & Company Pvt. Ltd.

G. Marr & B. W. Rockett, Practical Inorganic Chemistry, London ; New York : Van Nostrand Reinhold, 1972.

Reference Books:

A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS.

H.H Willard, L.L Meritt, I.A Dean, Instrumental Methods of Analysis, CBS Publishers, Delhi.

BSCH 254 ORGANIC CHEMISTRY – IV LAB (Credits 1.5)

List of Experiments

1. Systematic analysis of (N, S etc.) elements in the given unknown compounds and tests for unsaturation in the following compounds.

2. Qualitative analysis of the following types of unknown organic compounds

a. Carboxylic acids

b. Phenols

c. Alcohols

d. Aldehydes

e. Ketones

f. Esters

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. J. Mendham, R. C. Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.

2. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge University press, London.

3. B. S. Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry , ELBS with Longman, Longman Singapore Publishers Pvt. Ltd, Singapore.

4. F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

BSCH 256 PHYSICAL CHEMISTRY – IV LAB (Credits 1.5)

List of Experiments

(a) Study the kinetics of the following reactions: -

1. Initial rate method: Iodide-persulphate reaction

2. Integrated rate method:

(i) Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conductometrically.

(ii) Iodide-persulphate reaction

(iii) Saponification of ethyl acetate.

(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically

(c) To determine the strength of given acid solution (mono and dibasic acid)/KMnO4 – Mohr salt potentiometrically.

(d) To determine the molecular weight of a non-volatile solute by Rast method.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

REFERENCE BOOKS:

1. B. P. Levitt, Findlays Practical Physical Chemistry,Longman Group Ltd., London .

2. R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSCH 258 Analytical CHEMISTRY LAB (Credits 1.5)

List of Experiments

To determine the total hardness of water by complexometric titration method.

To determine the alkalinity of the water sample.

To determine the dissolved oxygen in the given sample of water.

To determine the acidity of the water sample.

To determine the percentage of available chlorine in the supplied sample of bleaching powder.

To determine the pH of given aerated drinks, fruit juices, shampoos and soaps.

Analysis of soil: (i) Determination of pH of soil, (ii) Total soluble salt

To separate a mixture of Ni2+ & Fe3+ by complexing with DMG and extracting the Ni2+ DMG complex in chloroform, and determine its concentration with spectrophotometry.

To estimate the percentage of acetic acid in vinager.

To determine the concentration of ascorbic acid in fruit juices/vitamin C tablets.

To determine the concentration of KMnO4 solution spectrophotometrically.

To determine the amount of sodium and potassium in a given sample of water by flame photometer.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

2. J. Mendham, R. C. Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.

REFERENCE BOOKS:

1. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge University press, London.

2. B. S. Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry , ELBS with Longman, Longman Singapore Publishers Pte Ltd, Singapore.

3. F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

BSCH 301 INORGANIC CHEMISTRY -V (Credits 4)

Course objective: The subject matter assimilated in this course provides:

knowledge about the general chemistry of d-block elements.

general features of electronic spectra of transition metal complexes.

magnetic properties of transition metal complexes.

UNIT I

General chemistry of 1st row d-block elements: Electronic configuration; Ionization potential; Oxidation states; Complex forming, magnetic, catalytic and spectral properties; Comparison of first transition elements with second and third series; Solution chemistry and complexes of Ti (III); Chemistry of vanadium(V) and vanadium(IV); Structure and formation of vanadates.

2nd and 3rd row d-block elements: Aqueous chemistry of Zr(IV); Chemistry of Nb(V); Dinitrogen complexes of Molybdenum; Mo-Mo and Re-Re quadrupole bonds. Chemistry of complexes of Rh(III), Pt(II) and Pd(II).

UNIT II

Chemistry of Cr and Mn complexes: Isolation of Cr from chromite ore; Chemistry of chromium(II); Binuclear compounds; Chemistry of Cr(III) complexes; The Chemistry of Cr (VI); Chromates, dichromates and peroxo complexes of Cr(IV), Cr(V) and Cr(VI); Chemistry of Mn(II) and Mn(III) complexes.

UNIT III

Electronic spectra of transition metal complexes: Electronic spectra of transition metal complexes: General features, Russell-Saunders coupling scheme; Selection rules; Orgel diagrams; Weak field splitting; Intermediate and strong field splitting; Tanabe and Sugano diagrams; Electronic spectra of d1-d9 metal complexes and f type compounds; Calculation of Dq, B and N of d1, d2 and d8 configurations.

UNIT IV

Magnetic properties of transition metal complexes: Magnetic behaviour of transition and inner transition elements and their compounds; Gouy's method for measuring magnetic susceptibility; Importance of magnetic susceptibility measurements in structure determination

of transition metal compounds; Anomalous magnetic moments; Magnetic exchange coupling and spin crossover.

TEXTBOOKS:

W. U. Malik, R. D. Madan, G. D. Tuli, Selected Topics in Inorganic Chemistry, S. Chand & Company Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

F. A. Cotton, G. W. Wilkinson and P. L. Gaus, Basic Inorganic Chemistry, John Wiley and Sons, New York.

J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman & Hall Ltd, London.

S. Chand, Modern Inorganic chemistry, S. Chand & Company Pvt. Ltd., New Delhi.

R. C. Aggarwal, Modern Inorganic Chemistry, 1st Edition (1987), Kitab Mahal, Allahabad.

N. N. Greenwood, & A. Earnshaw , Chemistry of the Elements, Butterworth Heinemann,1997.

G.E. Coater and M.L.H. Green, Principles of Organometallic Compounds, Chapman & Hall: UK, 1988.

B.E. Douglas and D.H. Mc Daniel, Concepts & Models of Inorganic Chemistry, Oxford Press.

B.R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shobhan Lal Nagin Chand& Co., New Delhi.

BSCH 313 ORGANIC CHEMISTRY -V (Credits 4)

Course objective: The contents of this course will help students to

learn structure of amino acids, peptides and various carbohydrates.

gain insight about salient structural features and techniques of synthesis of terpenes and alkaloids.

UNIT I

Carbohydrates: Occurrence, classification and their biological importance

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation;

Disaccharides: Structure elucidation of maltose, lactose and sucrose

Polysaccharides: Elementary treatment of starch, cellulose and glycogen.

UNIT II

Amino acids and Peptides: Amino acids, Peptides and their classification. α-Amino Acids: Synthesis, ionic properties and reactions, Zwitterions, pKa values, isoelectric point and electrophoresis;

Study of peptides: Determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups, Solid-phase synthesis.

UNIT III

Terpenes: Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Nerol and α- terpineol.

UNIT IV

Alkaloids: Natural occurrence, General structural features, Isolation and their physiological action; Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

TEXTBOOKS:

1. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand and Co. Ltd., New Delhi

REFERENCE BOOKS:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3. V. K Ahluwalia Textbook of Organic Chemistry Vol. III, , Ane Books Pvt Ltd. New Delhi.

BSCH 305 PHYSICAL CHEMISTRY -V (Credits 1.5)

Course objective: The course content of this course will help students to clarify the concept of phase rule and electrolytic conductance.

UNIT I

Phase equilibria-I: Concept of phases, components and degrees of freedom; Derivation of Gibbs phase rule for non-reactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria; Phase diagram for one component systems (H2O and CO2); Phase diagrams for two component systems involving eutectic (Pb-Ag), congruent (Zn-Mg).

UNIT II

Phase equilibria-II: Phase diagrams for two component systems involving incongruent melting points (Na-K and Na2SO4- H2O); Three component systems; Water-chloroform-acetic acid system; Triangular plots; Applications of phase rule equation.

UNIT III

Electrolytic Conductance-I: Arrhenius theory of electrolytic dissociation; Conductivity: Equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes; Molar conductivity at infinite dilution; Kohlrausch law; Debye-Huckel-Onsager equation; Wien effect; Debye-Falkenhagen effect; Walden's rules.

UNIT IV

Electrolytic Conductance-II:Ionic mobilities: Determination of ionic mobility, transport numbers and their relation to ionic mobilities; Determination of transport numbers by Hittorf and Moving Boundary methods; Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

TEXTBOOKS:

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, New Delhi.

Reference Books:

1. P. W. Atkins and J.de Paula, Atkin's Physical Chemistry, OxfordUniversity Press. Oxford.

2. G. W.Castellan, Physical Chemistry,Narosa.

3. R.G. Mortimer, Physical Chemistry, Elsevier: Noida, UP.

4. K. L. Kapoor, A textbook of Physical Chemistry (Vol. I), Macmillan Publishers India Ltd.

5. K. J. Laidler and J. M. Meiser, Physical Chemistry, Houghton Mifflin Comp., New York, International Edition.

6. P. C. Rakshit, Physical Chemistry, Sarat Book House, Kalkatta.

BSCH 311 BIOCHEMISTRY AND POLYMER CHEMISTRY (Credits 4)

Course objective: The underlying objective of this course is to

- Impart understanding regarding the biological importance of carbohydrates, proteins, enzymes and nucleic acids.
- Discuss structure of DNA and RNA.
- Provide information regarding synthesis and applications of different polymers.

UNIT I

Nucleic Acids: Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides.

UNIT II

Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle.

Proteins: classification, biological importance; Primary, secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Denaturation of proteins.

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

UNIT III

Lipids: Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications.

Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.

UNIT IV

Polymers: Introduction and classification including di-block, tri-block and amphiphilic polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index; Addition and condensation - Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics: Thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene); Natural and synthetic fibres (acrylic, polyamide, polyester); Natural and synthetic rubbers (Buna-S, Chloroprene and Neoprene); Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

TEXTBOOKS:

1. U. Satyanarayan and U. Chakrapani, Biochemistry, Elsevier Health Sciences.
2. Sunita Ratan, A text book of Engineering Chemistry, Vikas Publishing house.

REFERENCE BOOKS:

1. D.L. Nelson & M. M. Cox, Lehninger's Principles of Biochemistry, W. H. Freeman.

2. J.M. Berg, J.L. Tymoczko, & L. Stryer, Biochemistry, W. H. Freeman.

3. F.W. Billmeyer, Textbook of Polymer Science, John Wiley & Sons, Inc.

4. V. R. Gowariker, N. V. Viswanathan & J. Sreedhar, Polymer Science, New Age International (P) Ltd.

BSCH 315 CHEMISTRY OF FUELS AND PESTICIDES (Credits 1.5)

Course Objective: The underlying objective of this course is to

- Impart understanding regarding petrochemicals, their calorific value, reforming and fractionation techniques.
- Provide an insight about the chemistry of pesticides.

UNIT I

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

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

UNIT-II

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), 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-III

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

UNIT IV

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

TEXTBOOKS:

1. P.C. Jain, & M. Jain, Engineering Chemistry Dhanpat Rai & Sons, Delhi.75
2. B.K. Sharma & H. Gaur, Industrial Chemistry, Goel Publishing House, Meerut (1996).

REFERENCE BOOKS:

1. R. Cremlyn, Pesticides. Preparation and Modes of Action, John Wiley & Sons, New York, 1978.

2. P. R. Vijay Sarthi, Engineering Chemistry (Edition II), PHI Learning Pvt. Ltd. New Delhi.

3. V. M. Balsaraf (Sawargaonkar), Applied Chemistry-II, IK Intern. Publishing house Pvt.

BSPH 313 BASICS OF NANOSCIENCE-I (Credits 4)

Course Objective: The course incorporated in this paper will help students to

- understand the concepts of Nanotechnology.
- gain in sight about the nano world, nono structure, etc.
- understand the concepts of Fabrication and characterization of nano materials.

UNIT I

Introduction to Nano world: Introduction of nanotechnology, Classification of nanostructures, Properties of One dimensional, two dimensional and three dimensional nanomaterials, Fullerene, CNT, Quantum Dot, Effects of the nanometer length scale: Surface area and surface energy, effect of nanoscale on the structural, thermal, chemical, mechanical, magnetic, optical and electronic properties, Applications of Nanotechnology, Preparation, safety and storage issues, Clean Room.

UNIT II

Fabrication methods: Top-down processes (Milling, Machining, Focused ion beam Machining, Photolithography, X-ray Lithography, e-beam Lithography, Soft Lithography), Bottom-up processes(Vapour Phase Deposition, Sputtering, Chemical Vapour Deposition, MBE, Self Assembly, Colloidal Method, Sol-gel method). Fabrication of Carbon Nanotube.

UNIT III

Characterization of Nanomaterials: Topography, Morphology, Light Microscopy, Electron microscopy (Scanning Electron Microscope, Transmission Electron Microscope, Scanning probe Microscope, Scanning Tunneling Microscope, Atomic Force Microscope and Lateral Force Microscopy), Spectroscopy.

Transport Measurements

Electrical Resistivity and Hall Effect, Thermopower, Peltier Coefficient, and Thermal Conductivity.

UNIT IV

Magnetism in Nanomaterial's

Introduction, Magnetism in Matter: Hund's rule, Multiplicity, Magnetic Moment, Magnetic Order, Magnetocrystalline Anisotropy, Magnetization Process and Classification of Magnetic Materials, Energy of the Demagnetising Field. Domains and Walls.

Magnetic Order in Nanoparticles, Magnetostatics and Magnetisation Processes in Nanoparticles: Single-Domain Magnetic Particles, Superparamagnetism Effect, Magnetoresistance effect, Giant magnetoresistance effect GMR, Tunnel magnetoresistance Effect TMR.

TEXTBOOK

1. Nanoscale Science and Technology, R. W. Kelsall, I. W. Hamley and M. Geoghegan (John Wiley & Sons. Ltd.)

REFERENCE BOOKS:

Rakesh Rathi,Nanotechnology –Technology revolution of 21st century (S. Chand)

B.S. Murty, P.Shankar, Baldev Raj, B.B. Rath, James Murday, textbook of Nanoscience& Nanotechnology (Orient Blackswan Pvt. Ltd.)

Nanomaterials and Nanochemistry, C. Brechignac, P. Houdy, M. Lahmani, Springer

Chris Binns, Introduction to Nanoscience& Nanotechnology (Wiley).

B.K. Parthasarathy, Nanoscience& Nanotechnology (Isha Books).

Introduction to Magnetic Materials, B. D. Cullity, C. D. Graha (Wiley)

Solid State Chemistry and Its Applications, A. R. West, (Wiley).

BSPY 307 PHARMACEUTICAL MEDICINAL CHEMISTRY – I (Credits 4)

Course Objectives: To get familiar with the chemistry and synthesis of medicinal substances.

UNIT I

Basic Principles of Medicinal Chemistry: Concept of Prodrug & its applications. Mode of action, uses, structure activity relationship and synthesis of the following classes of drugs (synthetic procedures of individual mentioned drugs only).

UNIT II:

Hormone Related Drugs: Hypoglycemic agents: Tolbutamide, Chlorpropamide, Rosiglitazone, Glimepiride Phenformin, Metformin, Insulin. Thyroid & Antithyroid drugs: Propyl thiouracil, Methyl Thiouracil Methimazole, Carbimazole.

UNIT III: Drugs acting on Central Nervous system

General Anesthetics	-Thiopental, Phenobarbitone, Methohexital.
Local Anesthetics	-Lignocaine, Benzocaine.
Hypnotics and Sedatives	- Phenobarbitone, Pentobarbitone, Benzodiazepines.
Opioid Analgesics	-Morphine, Pethidine, Methadone, Pentazocine.
Antiepileptics	-Phenytoin, Troxidone, Carbamazepine

UNIT IV: Antimicrobials

Beta lactam antibiotics- Penicillins, (Penicillin G, Amoxycillin, Penicillin V, Methicillin)

Cephalosporins-Cefixime, Cephalothin.

Tetracyclines- Chlortetracycline, Oxytetracycline.

Aminoglycosides-Streptomycin, Gentamycin, Amikacin.

Macrolides antibiotics- Erythromycin, Azithromycin.

Miscellaneos antibiotics -Chloramphanicol, Polymixin

Antitubercular agents- Isoniazid, Rifampicin, Ethionamide

TEXTBOOK:

1.Singh H. and Kapoor V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

REFERENCE BOOKS:

Mann P.G. & Saunders B.C., Practical Organic Chemistry, ELBS/Longman, London.

2. Furniss B.A., Hannaford A.J., Smith P.W.G. and Tatehell A.R., Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

3. Pharmacopoeia of India, Minsitry of Health, Govt. of India.

4. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.

5. Nogrady T., Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.

6. Foye W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.

7. Finar I.L., Organic Chemistry, Vol I & II, ELBS/ Longman, London.

BSCH 309 SEMINAR (Credits 1)

Each candidate will be given one topic to present at the Seminar for 15 to 20 minutes and he/she will be evaluated by Panel of Examiners constituted for the same.

BSCH 351 INORGANIC CHEMISTRY – V LAB (Credits 1.5)

List of Experiments

Quantitative Analysis: The following quantitative estimations are to be carried out.

(i) Estimation of nickel (II) using Dimethylglyoxime as the precipitant.

(ii) Estimation of copper as CuSCN

(iii) Estimation of iron as Fe2O3 by precipitating iron as Fe(OH)3 through (i) Heterogeneous and Homogeneous media.

(iv) Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)3(aluminiumoxinate).

Inorganic Preparations

(i) Tetraammine copper (II) sulphate, [Cu (NH3)4] SO4 H2O

(ii) Potassium trisoxalatochromate (III), K3 [Cr (C2O4)3]

(iii) Cis and trans K[Cr(C2O4)2 (H2O2] Potassium dioxalatodiaquachromate(III)

(iv) Pentaamminecarbonato Cobalt (III) ion

Paper chromatographic separation of Fe3+, Al3+, and Cr3+

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

A.I. Vogel, Textbook of Quantitative Chemical Analysis, ELBS.

REFERENCE BOOKS:

O. P Pandey, D.N. Bajpai, S.Giri, Practical chemistry, S. Chand & Company Pvt. Ltd.

H.H Willard, L.L Meritt, I.A Dean, Instrumental Methods of Analysis, CBS Publishers, Delhi.

W. L. Jolly, The synthesis & characterization of Inorganic compounds, Prentice Hall.

R.A. Day and A.L. Underwood, Quantitative Analysis- 3 edition, Prentice Hall India, Pvt. Ltd. New Delhi, 1977.

G. Marr & B. W. Rockett, Practical Inorganic Chemistry, London ; New York : Van Nostrand Reinhold, 1972.

BSCH 353 ORGANIC CHEMISTRY – V LAB (Credits 1.5)

List of Experiments

1. Preliminary tests and qualitative analysis of following types of unknown organic compounds containing functional groups.

a. Carbohydrates

b. Primary, secondary and tertiary amines

c. Nitro compounds

d. Amides

e. Aryl halides

f. Hydrocarbons

Identification of the functional groups, C-C and C-N triple bonds, sp3, sp2 and sp hybridized C-H

bonds by IR spectroscopy (IR spectra to be provided)

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1.B. S. Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry , ELBS with Longman, Longman Singapore Publishers Pte Ltd, Singapore.

3. F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

4. J. Mendham, R. C. Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.

5. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

BSCH 355 Physical CHEMISTRY – V LAB (Credits 1.5)

List of Experiments

Colorimetry:

Verification of Lambert-Beer's Law

Determination of pK (indicator) for phenolphthalein or methyl red

Study the formation of a complex between ferric and thiocyanate (or salicylate) ions.

Study the kinetics of interaction of crystal violet with sodium hydroxide colourimetrically.

Spectrometry:

(i)Analysis of the given vibration-rotation spectrum of HCl(g)

(ii) Record the UV spectrum of p-nitrophenol (in 1:4 ethanol:water mixture). Repeat after adding a small crystal of NaOH. Comment on the difference, if any.

(iii)Record the U.V. spectrum of a given compound (acetone) in cyclohexane

Plot transmittance versus wavelength.

Plot absorbance versus wavelength.

Calculate the energy involved in the electronic transition in different units, i.e. cm-1, kJ/mol, kcal/mol & eV.

(c) Preparation of Sol

(i) To Prepare (a) Arsenious sulphide sol, (b) Ferric hydroxide sol, (c) Aluminium hydroxide sol and (d) Sulphur sol.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added)

TEXTBOOKS:

B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

REFERENCE BOOKS:

B. P. Levitt, Findlays Practical Physical Chemistry, Longman Group Ltd., London.

R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSCH 302 INORGANIC CHEMISTRY -VI (Credits 4)

Course objective: The subject matter incorporated in this course provides knowledge about

- Chemistry of organosulphur and organophosphorous compounds.
- Preparation and reactions of amines and heterocyclic compounds.
- Synthesis and applications of dyes and pigments.

UNIT I

Lanthanoids and Actinoids: Electronic configuration; Oxidation states; Trends in periodic properties; Colour, spectral and magnetic properties; lanthanide contraction, separation of lanthanides (ion-exchange method only); Comparison of short transition elements with inner transition elements; Acinide hypothesis and comparison of lanthanide and actinides.

UNIT II

Organometallics-I: Definition and terminologies and importance of organometallic chemistry; Preparation of metal carbonyls, binary carbonyls and mixed metal polynuclear carbonyls; Chemical reactions of metal carbonyls, structures of metal carbonyls (evidence from spectral and diffraction methods); Bonding in linear M-C-O groups.

UNIT III

Organometallics-II: Molecular hydrogen compounds; Metal nitrosyl compounds; Nitrosyl carbonyls; Dinitrogen and dioxygen complexes; Tertiary phosphines as ligand.

Complexes with aromatic systems; Cyclopentadiene complexes; Structure of cyclopentadiene-metal compounds; Metal-olefin complexes; Arene-metal compounds; Alkyne complexes.

UNIT IV

Inorganic polymers: Types of inorganic polymers and their comparison with organic polymers; Synthesis, structural aspects and applications of silicones and siloxanes; Borazines; Silicates; Phosphazenes and polysulphates.

TEXTBOOKS:

B.R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shobhan Lal Nagin Chand & Co., New Delhi.

REFERENCE BOOKS:

F. A. Cotton, G. W. Wilkinson and P. L. Gaus, Basic Inorganic Chemistry, John Wiley and Sons, New York.

J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman & Hall Ltd, London.

J. E. Huheey, E. A. Keiter, R. L.Keiter, Inorganic Chemistry: Principles of Structures and Reactivity; Harper Collins College Publishers, New York.

S. Chand, Modern Inorganic chemistry, S. Chand & Company Pvt. Ltd., New Delhi.

R. C. Aggarwal, Modern Inorganic Chemistry, Kitab Mahal, Allahabad.

Inorganic Chemistry, K.F. Purecell, and J.C. Kotz, W.B. Saunders Co. 1977.

H. Robert Crabtree, The Organomettalic Chemistry of the transition metals, John Willeys, 2000.

M.L.H. Green, Organometallic Compounds, Chapman & Hall: UK, 1968.

G.R. Canham, and Overton, Descriptive Inorganic Chemistry, T. Freeman & Co. 2006.

W. U. Malik, R. D. Madan, G. D. Tuli, Selected Topics in Inorganic Chemistry, S. Chand & Company Pvt. Ltd., New Delhi.

B.E. Douglas and D.H. Mc Daniel, Concepts & Models of Inorganic Chemistry, Oxford Press.

BSCH 304 ORGANIC CHEMISTRY- VI (Credits 4)

Course objective: The subject matter of this course will help students to

- Understand the basic concept of absorption and emission spectroscopy.
- Learn the principle of instrumentation and applications of IR, NMR and UV-Visible spectroscopy for identification of organic compounds.

UNIT I

UV-Visible Spectrometry-I: Origin of spectra and interaction of radiation with matter; General principles; Introduction to absorption and emission spectroscopy; Fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law; Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

UNIT II

UV-Visible Spectrometry-II: Basic principle 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; Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts; Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones,

carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); Distinction between cis and trans isomers.

UNIT III

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques; Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H- bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

UNIT IV

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

TEXTBOOKS:

1. Y. R. Sharma, Elementry Organic Spectroscopy, S. Chand.

Reference Books:

1. W. Kemp, Organic Spectroscopy, Macmillan.

2. P. S. Kalsi, Textbook of Organic Chemistry, New Age International (P) Ltd., New Delhi.

3. R. T. Morrison R.N. Boyd, Organic Chemistry, Pearson Education, New Delhi.

BSCH 306 PHYSICAL CHEMISTRY -VI (Credits 4)

Course objective: The subject matter incorporated in this course provides knowledge about the chemistry of organo sulphur, organophosphorous componds. preparation and reactions of amines and heterocyclic compounds. synthesisis and applications of dyes and pigments.

UNIT I

Photochemistry-I: Characteristics of electromagnetic radiation; the Jablonski diagram; Lambert-Beer's law and its limitations; Physical significance of absorption coefficients; Laws of photochemistry (Grothus –Draper law, The Stark- Einstein law); Quantum yield and its determination; Actinometry; Examples of low and high quantum yields.

UNIT II

Photochemistry-II: Kinetics of photochemical reactions; Photosensitization and quenching; The Sterm –Volmer equation; Photostationary states; Chemiluminescence; Role of photochemical reactions in biochemical processes; The theory of Lasers and its application in chemistry.

UNIT III

Quantum mechanics-I: The postulates of quantum mechanics; The Schrodinger wave equation; Operators in quantum mechanics; Solution of the Schrodinger wave equation for some simple systems: Particle in a one –dimensional box, Particle in a three –dimensional box, one dimensional simple harmonic oscillator, the rigid rotor, the Schrodinger wave equation for hydrogen atom; Angular momentum in quantum mechanics; Quantum numbers.

UNIT IV

Nuclear Chemistry: Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half life, mean life period), units of radioactivity.

TEXTBOOKS:

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, New Delhi.

REFERENCE BOOKS:

1. P. W. Atkins and J.de Paula, Atkin's Physical Chemistry , Oxford University Press. Oxford.

2. G. W. Castellan, Physical Chemistry, Narosa.

3. R.G. Mortimer, Physical Chemistry, Elsevier: Noida, UP.

4. K. L. Kapoor, A textbook of Physical Chemistry (Vol. I),Macmillan Publishers India Ltd.

5. K. J. Laidler and J. M. Meiser, Physical Chemistry, Houghton Mifflin Comp., New York, International Edition

6. P. C. Rakshit, Physical Chemistry, Sarat Book House, Calcutta.

7. Russell S. Drago. Physical methods for chemists, Saunders College Publishing, Hartcourt-Brace-Jovanovich College Publishers, New York.

BSCH 312 ENVIRONMENTAL AND GREEN CHEMISTRY (Credits 4)

Course objective: The study of environment is an important aspect to understand the environment so as to keep a balance between nature and scientific evolution and to mitigate the ill effects of technological revolution. The subject matter of this course provides:

- Knowledge about environment, ecosystems, and environmental pollution.
- Acquaintance with ideas of green chemistry, green solvent, and green technologies.

UNIT I

Environmental Pollution:

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its Management

Soil Pollution: Composition of soil, classification and effects of soil pollutants and their control.

Solid waste pollution: Classification, waste treatment and disposal methods, compositing, sanitary land filling, thermal process, re-cycling and re-use methods.

Hazardous waste: Classification – Radioactive, bio-medical and chemical, treatment and disposal – Physical chemical and bio-logical processes, Marine pollution.

UNIT II

Chemical Toxicology: Toxic chemicals in the environment, their impact on enzymes, biochemical effect of arsenic, cadmium, lead, chromium, mercury, and pesticides.

Eco-friendly Polymer: Polymer synthesis, environmental de-gradation of polymers, photo de-gradation of polymers, hydrolysis, hydro-biodegradable polymers, bio- polymers, bioplastics, thermal de-gradation of plastics during re-cycling.

Environmental Biotechnology: Bioaccumulation, biodegradation, bioremediation, bioleaching, biomenthanation.

UNIT III

Green Chemistry: The need of green chemistry; Principles of green chemistry; Introduction to green solvents and green catalysis: Water, ionic liquid, CO2, bio-catalysis.

UNIT IV

Green Technologies: Photochemistry; Sonochemistry; Microwave mediated organic synthesis with suitable examples.

TEXTBOOKS:

1. *A. K. De, Environmental Chemistry, New Age International* Publishers (*P*) *Ltd*. New Delhi.

2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi.

3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand & Company Ltd, New Delhi.

REFERENCE BOOK:

Paul Anastas, John Warner, Green Chemistry: Theory and Practice, Oxford University Press.

BSPH 326 BASICS OF NANOSCIENCE – II (Credits 4)

Course Objective: The course incorporated in this paper will help students to

- understand the concepts of Nanoparticles.
- gain in-sight about the applications of Nanomaterials.
- understand the concerns and challenges of nanotechnology.

UNIT I

Properties of Individual Nanoparticles: Metal Nanoclusters: Magic number, Theoretical modeling of Nanoparticles, Geometric structure, Electronic structure, Reactivity, Fluctuations, Magnetic Clusters, Bulk to Nanotransition, Semiconducting Nanoparticles: Optical properties, Photofragmentation, Coulombic explosion, Methods of Synthesis: RF plasma, Chemical Methods, Thermolysis, Pulsed Laser Methods.

UNIT II

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agriculture Industry, Cosmetics and Consumer Goods, Structure and Engineering, Automotive Industry, Water Treatment and the Environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space applications, Structural Applications.

UNIT III

Nanostructured Materials with High Application Potential: GaN Nanowires, Applications of GaN nanowires, Nanocrystalline ZnO, Crystal structure and properties of ZnO, Synthesis of bulk-structured and nanostructured ZnO, Applications of ZnO nanostructures, Nanocrystalline titanium oxide, Titania nanopowders, Titania nanotubes (TNTs), Multilayered Films

UNIT IV

Concerns and challenges of nanotechnology: Tiny science, huge concern, Does nanotechnology pose health risks?, What makes it dangerous?, Potential impact of nanomaterials on humans and the environment, Health issues with engineered nanomaterials, There is something fishy about these nanotubes, Adverse effects of quantum dots, Nanoparticles in living systems, Ecological aspects.

TEXTBOOK

B.S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, Textbook of Nanoscience and Nanotechnology, Universities Press.

REFERENCE BOOKS:

Charles P. Poole Jr., Frank J. Owens, Introduction to Nanotechnology, Wiley.

R. W. Kelsall, I. W. Hamley and M. Geoghegan. Nanoscale Science and Technology, (John Wiley & Sons. Ltd.).

BSPY 310 PHARMACEUTICAL MEDICINAL CHEMISTRY II (Credits 1.5)

Course Objectives: To get familiar with the chemistry and synthesis of medicinal substances.

UNIT I

Principles of Drug Design: Introduction to QSAR& Computer –aided drug design.

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of underlined drugs only)

UNIT II

Antineoplastics: Chlorambucil, Ifosfamide, Cyclophosphamide, Methotrexate, Fluorouracil, Thiotepa.

Antiviral drugs & Anti-HIV drugs: Amantadine, Acyclovir, Zidovudine

Antifungals: Ketoconazole, Fluconazole, Clotrimazole.

UNIT III

Cardiovascular Agents:

Antihypertensives: Amlodipine, verapamil, Captopril, Enalapril ,Nifedipine, Propranolol.

Anticoagulants: Clofibrate, Warfarin

UNIT IV

Antihistaminics:

H1 antagonists – Diphenhydramine, Promethazine, Chlorpheniramine, Cetirizine.

UNIT IV

Analgesics and Antipyretics: Aspirin, Mefenamic Acid, Paracetamol, Ibuprofen, Diclofenac, Rofecoxib, Valdecoxib.

Diuretics: Acetazolamide, Chlorothiazide, Frusemide, Spironolactone.

TEXTBOOK:

1. Singh H. and Kapoor V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi

REFERENCE BOOKS:

1. Mann P.G. & Saunders B.C., Practical Organic Chemistry, ELBS/Longman, London.

2. Furniss B.A., Hannaford A.J., Smith P.W.G. and Tatehell A.R., Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

3. Pharmacopoeia of India, Minsitry of Health, Govt. of India.

4. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.

5. Nogrady T., Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.

6. Foye W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.

7. Finar I.L., Organic Chemistry, Vol I & II, ELBS/ Longman, London.

BSCH 352 In ORGANIC CHEMISTRY – VI LAB (Credits 1.5)

Gravimetric Analysis:

Estimation of Barium as barium sulphate, Sulphate as $BaSO_4$, Silver as AgCl, Chloride as silver chloride, Zinc as zinc oxide, Copper as cupric oxide, Iron as ferric-oxide, Aluminium as Al_2O_3, Chromium as chromic oxide, Cr_2O_3, Lead as lead sulphate.

Preparation of Inorganic Compounds:

(i) $CoHg(SCN)_4$; (ii) Cu(I) thiourea complex; (iii) Bis (2, 4-pentanedionate) zinc hydrate.

(c)Paper Chromatographic separation of Ni (II) and Co(II); Cu(II) and Cd (II).

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

A.I. Vogel, a Textbook of Quantitative Inorganic Analysis, ELBS.

Reference Books:

O. P Pandey, D.N. Bajpai, S. Giri, Practical chemistry, S. Chand & Company Pvt. Ltd.

H.H Willard, L.L Meritt, I.A Dean, Instrumental Methods of Analysis, CBS Publishers, Delhi.

BSCH 354 ORGANIC CHEMISTRY – VI LAB (Credits 1.5)

List of Experiments

1. Qualitative analysis of following types of unknown organic compounds

a. compounds containing halogens

2. Preparation of Methyl Orange.

3. Preparation of Benzoin.

4. Preparation of Benzil.

5. Preparation of Dibenzal acetone

6. Preparation of Methyl Salicylate

7. To study some simple tests of proteins.

(Note: A candidate must perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

1. S. Ratnani and S. Gurjar, Experimental Organic Chemistry, PHI Learning Pvt. Ltd., New Delhi

REFERENCE BOOKS:

1. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge University press, London.

2. B. S. Furniss, A. J. Hannaford, P. W. G Smith and A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley(India) Pvt Ltd., (Pearson Education) New Delhi.

3. F. G. Mann and P. C. Saunders, Practical Organic Chemistry, Green and Co. Ltd., London.

4. O.P. Giri, D.N. Bajpai and S. Giri, Practical Chemistry, S. Chand and Company Pvt. Ltd., New Delhi.

5. J. Mendham, R. C. Danney, J. D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, Chennai.

BSCH 356 Physical CHEMISTRY – VI LAB (Credits 1.5)

List of Experiments

To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.

To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi – and trivalent anions.

To determine the CST of phenol – water system.

To study the distribution of iodine between water and CCl4.

Kinetics of catalytic decomposition of H2O2.

Kinetics of acid-catalyzed hydrolysis of sugar (chemical method).

Determination of relative strengths of two acids by studying the kinetics of acid-catalyzed ester hydrolysis.

Order of reaction of I2 / Acetone / H+.

Equilibrium constant of methyl acetate hydrolysis reaction

Dissociation constants of weak acid, base.

(Note: A candidate has to perform at least eight experiments in the lab. Any suitable experiment may be added.)

TEXTBOOKS:

B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi.

Reference Books:

B. P. Levitt, Findlay's Practical Physical Chemistry, Longman Group Ltd., London.

R. C. Das and B. Behra, Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

BSCH 358 RESEARCH PROJECT (Credits 5)

Dissertation based on Research project: Suitable Topics in Chemical Sciences

Presentation & Viva-voce

1. Students will be divided among faculty members of the Department for the supervision of the research work.

2. In the first week of Semester V, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of chemical sciences.

3. The student will work on the assigned research topic during semesters V and VI in regular consultation with his/her assigned teacher.

4. The student will write a dissertation based on the research work carried out during Semesters V and VI and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the supervisor in the sixth week of VI semester or a date decided by the HOD of the department.

5. Before preparing power point presentation and submission of dissertation, each student has to deliver a seminar talk on his/ her research project work on a date fixed by HOD, necessary suggestions has to be incorporated in the final draft of dissertation.

6. The student will make a power point presentation based on the work carried out and mentioned in the dissertation to the board of examiners appointed by the University.

Annexusre 'A'

B.Sc. (H) Chem.			**Year 2018-2021 (Scheme of Studies)**				**SBAS**
YEAR	**ODD SEMESTER**				**EVEN SEMESTER**		
	SN	**COURSE CODE**	**COURSE TITLE**	**Credits**	**SN**	**COURSE CODE**	**COURSE TITLE**	**Credits**
FIRST	**1**	**BSCH111**	INORGANIC CHEMISTRY-I	4	**1**	**BSCH112**	INORGANIC CHEMISTRY-II	4
	2	**BSCH113**	ORGANIC CHEMISTRY-I	4	**2**	**BSCH114**	ORGANIC CHEMISTRY-II	4
	3	**BSCH117**	PHYSICAL CHEMISTRY-I	4	**3**	**BSCH118**	PHYSICAL CHEMISTRY-II	4
	4	**BSMA141**	MATHEMATICS-I	4	**4**	**BSEL101**	COMMUNICATION SKILLS	4
	5	**BSCH125**	ENVIRONMENTAL STUDIES	3	**5**	**BSPH120**	PHYSICS-I	4
	6	**BSCS113**	INTRODUCTION TO COMPUT- ERS AND PROGRAMMING	3	**6**	**BSCH152**	INORGANIC CHEMISTRY-II LAB	1
	7	**BSCH151**	INORGANIC CHEMISTRY-I LAB	1	**7**	**BSCH164**	ORGANIC CHEMISTRY-II LAB	1
	8	**BSCH153**	ORGANIC CHEMISTRY-I LAB	1	**8**	**BSCH156**	PHYSICAL CHEMISTRY-II LAB	1
	9	**BSCH155**	PHYSICAL CHEMISTRY-I LAB	1	**9**	**BSPH158**	PHYSICS-I LAB	1
	10	**BSCS157**	C PROGRAMMING LAB	1	**10**	**BSEL171**	COMMUNICATION SKILLS LAB	1
	11	**BSMA131**	DATA PRESENTATION FOR SCI- ENCES	1				
	TOTAL			27	**TOTAL**			25
SECOND	**1**	**BSCH211**	INORGANIC CHEMISTRY-III	4	**1**	**BSCH212**	INORGANIC CHEMISTRY-IV	4
	2	**BSCH213**	ORGANIC CHEMISTRY-III	4	**2**	**BSCH214**	ORGANIC CHEMISTRY-IV	4
	3	**BSCH215**	PHYSICAL CHEMISTRY-III	4	**3**	**BSCH226**	PHYSICAL CHEMISTRY-IV	4
	4	**BSPH217**	PHYSICS-II	4	**4**	**BSCH218**	ANALYTICAL CHEMISTRY	4
	5	**BSEL217**	PERSONALITY DEVELOPMENT AND COMMUNICATION SKILLS	3	**5**	**BSMA142**	MATHEMATICS-II	4
	6	**BSCH251**	INORGANIC CHEMISTRY-III LAB	1.5	**6**	**BSCH252**	INORGANIC CHEMISTRY-IV LAB	1.5
	7	**BSCH253**	ORGANIC CHEMISTRY-III LAB	1.5	**7**	**BSCH254**	ORGANIC CHEMISTRY-IV LAB	1.5
	8	**BSCH255**	PHYSICAL CHEMISTRY-III LAB	1.5	**8**	**BSCH256**	PHYSICAL CHEMISTRY-IV LAB	1.5
	9	**BSPH257**	PHYSICS-II LAB	1	**9**	**BSCH258**	ANALYTICAL CHEMISTRY LAB	1
	TOTAL			24.5	**TOTAL**			25.5
THIRD	**1**	**BSCH301**	INORGANIC CHEMISTRY-V	4	**1**	**BSCH302**	INORGANIC CHEMISTRY-VI	4
	2	**BSCH313**	ORGANIC CHEMISTRY-V	4	**2**	**BSCH304**	ORGANIC CHEMISTRY-VI	4
	3	**BSCH305**	PHYSICAL CHEMISTRY-V	4	**3**	**BSCH306**	PHYSICAL CHEMISTRY-VI	4
	4	**BSCH311**	BIOCHEMISTRY AND POLYMER CHEMISTRY	4	**4**		ELECTIVE	4
	5		ELECTIVE	4	**5**	**BSCH352**	INORGANIC CHEMISTRY-VI LAB	1.5
	6	**BSCH309**	SEMINAR	1	**6**	**BSCH354**	ORGANIC CHEMISTRY-VI LAB	1.5
	7	**BSCH351**	INORGANIC CHEMISTRY-V LAB	1.5	**7**	**BSCH356**	PHYSICAL CHEMISTRY-VI LAB	1.5
	8	**BSCH353**	ORGANIC CHEMISTRY-V LAB	1.5	**8**	**BSCH358**	RESEARCH PROJECT	5
	9	**BSCH355**	PHYSICAL CHEMISTRY-V LAB	1.5				
	TOTAL			25.5	**TOTAL**			25.5
	ELECTIVE ODD SEMESTER				**ELECTIVE EVEN SEMESTER**			
	1	**BSCH315**	CHEMISTRY OF FUELS AND PESTICIDES	4	**1**	**BSCH312**	ENVIRONMENTAL AND GREEN CHEMISTRY	4
	2	**BSPH313**	BASICS OF NANO SCIENCES-I	4	**2**	**BSPH326**	BASICS OF NANO SCIENCES-II	4
	3	**BSPY307**	PHARMACEUTICAL MEDICINAL CHEMISTRY-I	4	**3**	**BSPY310**	PHARMACEUTICAL MEDICINAL CHEMISTRY-II	4
							TOTAL CREDITS [C]	153