YEARWISE AND SEMESTERWISE DISTRIBUTION OF SUBJECTS
B.Sc. BIOTECHNOLOGY, CHEMISTRY & GENETICS
FIRST SEMESTER
ACADEMIC YEAR-2021-22 OF (2021-24) BATCH (CBCS)

Sl. No.	Part	Subject Code	Title of the Subject	Hours/ Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
THEORY									
1	I	EN18101	General English- I **(AECC-1)**	3	3	40	60	100	3
2	I	VE18101	Value Education & Personality Development **(AECC-2)**	2	3	40	60	100	2
3	II	BT19101	Cell and Molecular Biology **(GE-1)**	4	3	40	60	100	4
4	II	BT19102	Genetic Analysis **(CORE-1)**	4	3	40	60	100	4
5	II	BT19103	Biochemistry and Metabolism **(CORE-2)**	4	3	40	60	100	4
6	II	BT19104	Chemistry-I **(CORE-3)**	5	3	40	60	100	4
PRACTICALS									
7	II	BT19105	Cell and Molecular Biology **(GE-1)**	2	3	40	60	100	1
8	II	BT19106	Genetic Analysis **(CORE-1)**	2	3	40	60	100	1
9	II	BT19107	Biochemistry and Metabolism **(CORE-2)**	2	3	40	60	100	1
10	II	BT19108	Chemistry-I**(CORE-3)**	2	3	40	60	100	1
TOTAL				**30**		**400**	**600**	**1000**	**25**

*AECC Ability Enhancement Compulsory Course *GE Generic Elective

GENERAL ENGLISH -I

Credits: 3 **Semester: I**

Subject Code: EN18101 **No. of Lecture Hours: 45 Hrs**

Objectives:

- To enhance the learners' communication skills by giving adequate exposure in reading, writing, listening and speaking skills and the related sub-skills.
- To develop oral and written communicative skills among the students so that their employability enhances, and English becomes the medium of their livelihood and personality.

Outcome: Students will be able to identify and implement new linguistic skills and communication skills through role play and group discussions.

UNIT-I **9Hr**

Wit and Humor

From the text "A Tea Party" by Ruth Prawer Jhabvala

- Explanation of the text 2
- Grammar----Nouns, Articles 2
- Vocabulary---Homonyms, homophones, homographs 2
- Writing Skill--- Note- Making 2
- Speaking Skill – Note-Making 1

UNIT-II **9Hrs**

Risk Management

From the text "Deadly Factory Fires in India."

Explanation of the text 2

- Grammar----Tenses – The Present Tense 2
- Vocabulary ---Synonyms 2
- Writing Skill--- Information Transfer 2
- Speaking Skill--- 1

UNIT-III **9HrS**

Human Values

From the text" India's Contribution to World Unity"

- Explanation of the text 2
- Grammar--- Tenses- The Past Tense 2
- Vocabulary ---- Adjective and Adverb Suffixes 2
- Writing Skill--- Formal Letters. Curriculum Vitae 2
- Speaking Skill--- JAM 1

UNIT-IV **9Hrs**

The Cyber Age

From the text "Polymer Bank Notes"

- Explanation of the text 2
- Grammar----Concord or Subject Verb Agreement 2
- Vocabulary -----Word Formation. Collocations. 2
- Writing Skill---- References and Bibliographies. 2
- Speaking Skill--- Presentations 1

UNIT-V **9Hrs**

Sports

From the text "Sachin Tendulkar"

- Explanation of the text 2
- Grammar------Adjectives, Comparison of Adjectives 2
- Vocabulary—CommonErrors,CommonlyMispeltWords,Commonly Confused Words 2
- Writing Skill- Technical Reports, Project Reports 2
- SpeakingSkill----GroupDiscussions 1

ESSENTIAL READING:

Skills Annexe. **Functional English for Success.Orient Black Swan**

SUGGESTED READING

- Balasubramaniam, M. 1985 **Business Communication**. New Delhi: Vani Educational Books.
- Krishna Mohan and Meera Banerjee, 1990. **Developing Communication Skills.** New Delhi: Macmillan India Ltd.
- Krishnaswamy.N. and Sriraman, T. 1995. **Current English for Colleges.** Madras: Macmillan India Ltd.
- Narayanaswamy.V.R. 1979 Strengthen **Your Writing**. New Delhi: Orient Longman.
- Sharma.R.and Krishna Mohan. **Business Correspondence.** 1978. New Delhi. Tata McGraw-Hill Publishing Co.

VALUE EDUCATION & PERSONALITY DEVELOPMENT

Credits : 2 **Semester: I**
Subject code : VE18101 **No. of Lecture hours:30**

Objectives:

- To make students become aware of the good and evil present within and around them and enable them to move from evil to good. To enable them to be culturally conscious and socially sensitive;
- To make them aware of mass media and its positive and negative impact;
- To make them aware of their fundamental rights and duties;
- To help them become aware of the importance of holistic health and to sensitize them regarding some health hazards;
- To clarify some basic issues of life and make them responsible towards the betterment of society.

Outcome: Students will be able to share, incorporate and synthesize sound values like love, sharing, integrity, concern and respect for others.

UNIT- I **6Hrs**

Introduction to Ethics

- Why Value Education? 2
- Reasons to have Ethics for Life 1
- Accepted Norms and Counter Values 1
- Dimensions of Human Development: Physical, Intellectual, Emotional, Moral, Spiritual and Social 2

UNIT-II **6Hrs**

Approach to Life

- Conscience and Pseudo-Conscience 1
- Happiness as Lifegoal 1
- Values revealed and lived in Religions 1
- Experience of God 1
- Love: The three components of Love 1
- Some of the basic stages and issues of Life: Family, Love, Sex, Marriage 1

UNIT-III **6Hrs**

Concern for Others

- Self and Another 2
- Human Context 2
- Moral Problems of a Society / True Society: Social Desire, Social Fear, Social Silence, Social Indifference 2

UNIT-IV **6Hrs**

Transformation of Self

- Definitions of personality 1
- Characteristics of personality 1
- Elements of personality 1
- Traits of good personality 1
- Self-Identity, self-concept 1
- Self-Discovery, self-acceptance 1
  Self-Esteem

WORK SHEET (1): Self Estimation

UNIT-V **6Hrs**

Life Enrichment Skills

- Purpose of life - Goal setting
- Characteristics of Goals 1
- Building Relationships
- Time Management 1
- Stress Management
- Emotional Management 2
- Conflict Management 1
- Team Management (Group Dynamics) 1

WORK SHEETS (1) & (2): 1) Anger Management
2) Team Management

ESSENTIAL READING:

1. Human Values - Development Programme - AIACHE
2. In Harmony

CELL and MOLECULAR BIOLOGY

Crédit : 4 **Semester : I**
Subject Code : BT19101 **No. of Lecture Hours: 60 hrs**

Objectives:

- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially membranes and organelles.
- To understand how these cellular components are used to generate and utilize energy in cells.
- To apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

Outcome: Students will be able to gain Knowledge in the concepts of cell structure and function understanding the metabolic processes of cells in terms of cellular organelles, membranes, and biomolecules

Unit specific outcomes:

- Students will be able to describe cytological, biochemical, physiological and genetic.
- students will acquire knowledge about the organizational and functional aspects of cell organelles.
- Students will be able learn about cellular processes common to all cells &interactions of the cells.
- Students will gain knowledge and will be able to explain cellular processes and mechanisms that lead to physiological functions & cell death.
- students will gain an indepth understanding on genome organization

UNIT-I **12Hrs**

Cell &Broad classification of Cell types

Cell (Structure &Function)	2
Cell Theory (its postulates)	2
Pre cellular evolution	1
Pleuro Pneumonia ike organisms (general features)	1
Prokaryotic & Eukaryotic cell (general features)	2
Difference between prokaryotic & eukaryotic cell	1
Different types of cells& Specialised functions Fibroblast cell, Muscle cell & Nerve cell	3

UNIT-II **12Hrs**

Structure and function of cell organelles

Plasma membrane (Elementary level)	1
Golgi complex	2
Endoplasmic reticulum	1
Ribosomes	2
Mitochondria	2
Chloroplast	1
Lysosomes (Elementary level)	1
Peroxisomes (Elementary level)	1
Nucleus & Nucleolus	1

UNIT-III **12Hrs**

Cell divison , Cell cycle and Cell signalling

Cell cycle : Phases of Cell Cycle	1
Mitosis –(Cell division)-significance	2
Meiosis- (Cell division)-significance	2
Components in Cell Cycle control – Cyclins, CDKs	2
Check points in Cell cycle	1
Cell communication & Modes of cell signalling (Direct and Indirect)	2
Intra and intercellular signalling	1
Receptors and Signaling molecules - Steroid hormones, Neurotransmitters (Elementary level)	1

.

UNIT-IV **12Hrs**

Cellular processes

Cell growth (Elementary level)	1
Cell differentiation (eg Haematopoiesis...)	2
Cell motility (Elementary level)	1
Cell death (Apoptosis)	1
Intrinsic and extrinsic pathways of Apoptosis	2
Regulation of Apoptosis	2
Cell Senecence-Necrosis	2
Difference between Apoptosis and Necrosis	1

UNIT-V **12Hrs**

DNA, Chromosomes and Genome

DNA as genetic material- Griffith's experiment,Hershey and chase experiment. 3
RNA as genetic material 1
DNA reassociation kinetics (Cot curve analysis); C-value paradox,
Tm curve, Genome complexicity 2
Genome organization in prokaryotes(Elementary level) 1
Genome organization in Eukaryotes(Elementary level) 1
Features of Genome-Unique,Moderate and Highly repeated sequences,Tandom repeats(Satellite,Minisatellite and Micro satellite),Interspersed Repeats (SINES-Alu repeats,LINES) 3
Extranuclear genome (Mitochondrial and chloroplast genomes)(Elementary level) 1

SUGGESTED READING:

1. Goffrey.M.Cooper. 2000. **The Cell- A Molecular Approach.** Washington: D.C. ASM press.
2. Gerald Karp. 2008. **Cell and Molecular Biology.** New York: Wiley publishers.
3. David.E.Sadava. 1993. **Cell Biology-Organelle Structure and Function.** Bangalore: Panima publishing corporation.
4. Dr.Arumugam.N. 2005. **Cell Biology.** Kanyakumari: Saras Publication.

GENETIC ANALYSIS

Credits: 4 **Semester: I**
Subject Code: BT19102 **No. of Lecture Hours : 60**

Objective: Genetic analysis helps to study and do research in fields of science involving genetics and molecular biology.

Outcome: Students will be able to gain Knowledge in the concepts of inheritance of genes and structure and types chromosome.

UNIT -I **12Hrs**

Introduction to Genetics

- Mendelian Genetics: - Mendel's experiment with pea plant, reasons of his success, salient features of Mendelism — 2
- Terminology and definition dominant and recessive character, Pure line, Reciprocal crossTest cross, Back cross. — 2
- Monohybrid cross - law of segregation — 3
- Dihybrid cross – law of independent assortment
- Extra chromosomal inheritance in *mirabilus jalapa* – variegated leaves, paramecium and yeast. — 3
- Inheritance of Quantitative traits – skin colour in man, ker nal colour in wheat — 2

UNIT -II **12Hrs**

Extension to mendelian segregation patterns

- Variation in dominance relation- Co-dominance, incomplete dominance — 2
- Lethals - Dominant lethals, recessive lethals, balanced lethal stocks — 2
- Gene interaction – Epistasis - Dominant epistasis, duplicate dominant — 2
  epistasis, duplicate recessive epistasis — 1
- Brief note on segregation distortion. — 1
- Brief note on Penetrance & Expressivity — 1
- Phenocopies, Isoalleles and pseudoalleles — 1
  — 1
- Blood grouping - ABO and Rh system — 1

UNIT –III **12Hrs**

Genetics of sex determination and sex-linked inheritance

- Sex determination mechanism in Drosophila – Genic balance theory 2
- Sex determination mechanism in birds & plants (Melandrium album) 2
- Sex determination mechanism in Man - SRY genes, PAR region 2
- Short note on Sex chromatin and inactivation of X- Chromosome 2
- Sex linked inheritance - X linked and Y linked inheritance (holandric genes) 3
- Sex influenced genes and sex-limited genes 1

UNIT –IV **12Hrs**

Genome structure and organization

- Chromosome - Size, morphology, shape , structure of chromosome 2
- Brief note on Heterochromatin and Euchromatin 1
- Organisation of chromatin – Packing of DNA, histones and non-histones 2
- Specialized chromosomes – Lamp brush and polytene chromosomes, supernumary chromosomes 2

Chromosomal Changes

- Changes in chromosome structure – deletions, duplications, inversions and translocations 3
- Changes in chromosome number – Anueploids, Euploids, Autopolyploids, allopolyploids 2

12Hrs

UNIT –V

Linkage, recombination and mapping

- Discovery of linkage, phases of linkage – coupling and repulsion, complete and partial linkage 2
- Chiasmata and crossing over 1
- Linkage analysis and gene mapping in Neurospora - tetrad analysis 2

- Recombination in bacteria – transformation, transduction and conjugation and mapping by these methods. 4

- Brief account of recombination in viruses – Bacteriophage mutants, recombination analysis and deletion mapping 3

SUGGESTED READING

- Anthony J. F. Griffiths etal.2000. **An Introduction to Genetic Analysis** 7th edition; USA: Freeman and Company..
- Peter, J. Russel .1996**. Genetics** ; Harper Collins college Publishers
- Lewin, Benjamin: Genes VII**,** Oxford press
- Klug, S. William & Cummings, Michael R..1997. **Concepts of Genetics** BIOS Scientific Publishers Ltd.
- Powar C.B.2007. **Genetics volume I and II** Himalaya Publishers
- Gardner, John Eldon .2001**. Principles of Genetics** -8th edition; John Wiley and Sons (Asia) Pvt.Ltd.
- Snustad,D.Peter& Simmons,Michael J.2003. **Principles of Genetics- 3rd edition** ; John Wiley and Sons .
- Fairbanks,Daniel J.1999**. Genetics:the continuity of life** ; Brooks/Cole Publishing Company.

BIOCHEMISTRY & METABOLISM

Credits : 4 **Semester : I**
Subject Code : BT19103 **No. of Lecture Hours :60**

Objective:

- To be well versed with the basics in Biochemistry
- To identify the five classes of polymeric biomolecules and their monomeric building blocks.

Outcome: Student will gain knowledge on the study of structures, functions and interactions between biological molecules taking place in the living body.

Unit specific Outcomes:

- Understanding carbohydrates and its metabolic pathways - the energy-yielding and energy requiring reactions in life
- Illustrate different types of lipids and relate their structure to their role in biological systems.
- Recognize amino acid structures, describe their physical and chemical properties, and understand protein classification.
- Recognise the structure of nucleic acids, DNA and RNA.
- Understanding chemical nature of enzymes and Vitamins, its classification and properties.

UNIT – I Carbohydrates 12Hrs

• Definition and Significance of Carbohydrates	1
• Asymetrical carbon atom, Anomers, Epimers, Reducing and non-reducing sugar, Mutarotation, Osazone formation and Glycosidic bond.	1
• Classification – Monosaccharides, Oligosaccharides & Polysaccharides	2
• Glycolysis (General features, Significance and Energetics)	2
• TCA Cycle (General features, Significance and Energetics)	2
• ETC, Chemiosmotic theory	2
• HMP Shunt (General features, Phases and Significance)	2

UNIT – II Lipids 12Hrs

• Definition and functions of Lipids	1
• Classification of lipids – Simple, Complex & Derived	3
• Even and odd chain fatty acids, Saturated & unsaturated fatty acids, essential and non-essential fatty acids.	2
• Properties of Lipids – Acid value, saponification number, iodine number	2
• Beta oxidation - degradation of Palmitoyl Co A	2
• Ketone bodies – its synthesis	2

UNIT – III Amino acids and Proteins

• Amino acid – General structure of Amino acid	12Hrs
• Classification of Amino acid – based on structure and polarity	1
• Physical properties of Amino acids Physical	2
• Standard and Non-standard Amino acids.	1
• Essential and Non essential amino acids	1
• Generation of Protein structural levels(Primary, Secondary, Tertiary and Quaternary levels)	2
• Amino acid sequencing (Reaction of proteins with sangers, Dansyl chloride, Edmans method & Carboxypeptidase method).	2
• Proteins – Elemental composition of proteins	
• Proteins – Structure & Dynamic Properties	1
• Classification of proteins – based on function, composition & solubility	2

12Hrs

UNIT - IV Nucleic acids

• Definition and functions of Nucleic acid	1
• Components of Nucleic acid - Purines & Pyrimidines, sugars of Nucleic acid and Phosphate group	2
• Structure of DNA – Watson & Crick Model.	1
• Schematic representation of polynucleotides	1
• Chargaff's rule of DNA composition	1
• Watson and Crick model of DNA	2
• Different conformations of DNA – A, B & Z	
• Structure and types of RNA	2
• Disorders of Purines (Gout, Lesch Nyhan syndrome) and Pyrimidines (Orotic aciduria, SLE)	2

12Hrs

UNIT – V Enzymes & Vitamins

• Definition and significance of enzymes	1
• Definition – apoenzyme, holoenzyme, prosthetic group, cofactor and coenzyme	1
• Active site	1
• Enzyme classification with examples	2
• Factors affecting enzyme activity(substrate, pH, temperature, enzyme concentration).	2
• Enzyme Inhibition – competitive, non competitive (elementary level).	1

- Vitamins – classification – fat soluble and water soluble 2
- Sources, chemical nature (without structure) 1
- Functions of vitamins 1

SUGGESTED READING:

1. Lehninger, Nelson and Cox, 1993, **Principles Of Biochemistry**, New Delhi: V-Edition CBS Publishers.
2. Stryer, Lubert , 2000 **Biochemistry**, New York: VI edition, Freeman and Co,.
3. Murray, R.K and P A Mayer , Harper's. 2002 **Biochemistry** New York: 25 edition McGraw Hill Inc.,.
4. Devlin, Thomas M. 1997. **Textbook of Biochemistry with clinical correlations** New York: IV edition. Wiley Liss.
5. Zubay G. F, Parson W.W, Vance D.E. 1998**. Principles of Biochemistry**, England: IV edition. WBC Publishers.
6. Conn E.E and Stumpf. 1998. **Outlines of Biochemistry**. New York: V Edition John Wiley and Sons.
7. Deb A. C. 2008. Fundamentals of Biochemistry. Kolkatta: IX edition. New central agency (P) Ltd.

CHEMISTRY – I

Credits: 4 **Semester: I**
Subject Code: BT19104 **No. of Lecture Hours: 75**

Objective: Intends student to complete a major or minor studies in Chemistry.

Outcome: Students will be able to gain the concepts and problem solving knowledge in Physical Chemistry.

Unit Specific Outcomes:

- Analyse the energy changes in a given physical or chemical process.
- Apply the concept of feasibility of a process
- Compare the electrical conductivities of various conductors
- Evaluate cell potential, compare various electrodes
- Explain various phases in a heterogenus system, apply the concept to separate various phases

UNIT-I **15Hrs**
Thermodynamics-I
Analyze about energy changes in a given process.

- Introduction-Definition, importance & limitations. Terms involved-Types of Thermodynamic systems. Thermodynamic properties, Thermodynamic Processes. 3
- Work-Definition, Units PV-Work, Work done in Isothermal reversible &Irreversible Process. Internal Energy, Enthalpy and relation between them (dE+PdV=dH). 2
- First law of Thermodynamics in various forms, Problems. 2
- Heat Capacity-Molar heat capacity- C_v&C_p and their relation, Problems. 2
- Joule Thomson Effect-Definition, explanation-Isoenthalpic Process-J.T.Coefficient 2
- Adiabatic Expansion-Adiabatic changes in ideal gas derivation of PV^{γ}=constant, $TV^{\gamma-1}$=constant; P-V curves for isothermal and adiabatic processes. 2
- Variation of heat of reaction with temperature-Kirchoff's equations. 2

UNIT -II

15hrs

Thermodynamics-II

- Limitations of I law of Thermodynamics, Need of second law, Spontaneous (irreversible)process. Carnot Cycle- Carnot Theorem. Problems. 3
- Concept of Entropy – Derivation entropy from Carnot Cycle, units. Entropy change in reversible &irreversible process. 3
- Calculation of entropy change of Ideal gas with change in P,V&T. Physical significance of entropy change. 2
- Work function (A) & Gibbs Free Energy (G), Variation of free energy change with T,P. 2
- Gibbs Helmoltz Equations, importance. Criteria for Spontaneity 2
- Clasius-Clapeyron Equation, importance. 3

UNIT-III **15Hrs**

Electro Chemistry–I

Determine the electrical conductivity of a given substance.

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- Conductance- Specific Conductance , Equivalent Conductance & Molar Conductance experimental determination of Equivalent Conductance, k, & μ. Problems. 3
- Conductometric Titrations – Definition- Explanation of Principle, procedure & graphs for (i)SA vs SB (ii)SA vs WB (iii)WA vs SB (iv)WA vs WB (v)[SA+WA] vs SB (vi)$AgNO_3$ vs KCl. 3
- Migration of Ions. Kohlrausch law of Independent migration of ions applications. 2
- Effect of dilution on Conductance; Strong &Weak electrolytes. 1
- Transport Number – Definition – Hittorf Rule –Hittorf method to determine transport number of ions. Problems. 3
- Debye Huckel Theory of Strong Electrolytes – Debye Huckel Onsager Equation (elementary treatment). 3

UNIT-IV 15Hrs

Electro Chemistry–II

- Common Ion Effect – Definition , application in Qualitative analysis 2
- Electro chemical cells-definition, construction. Representation of electro chemical cell, 2
- EMF, SEP, SRP/SOP. Features of Electro Chemical Series. Problems. 2

- Nernst Equation – (i) Calculation of Half cellpotential (ii)Calculation of cell potential. Problems. 3
- Reference Electrodes – Definition, construction &working of (i) SHE (ii)SCE. 3
- Commercial cells-working of Pb-storage cells. 3

UNIT : V **15Hrs**

Phase Rule

Compare various phases in a heterogenous system and apply the concept to separate different metals from mixtures.

- Homogenous &Heterogenous Systems – Gibbs Phase Rule. 3
- Definition terms involved with suitable examples. 3
- True & Metastable Equilibrium. 2
- One Component System-Water System-Phase Diagram. 3
- Two Component System- Pb-Ag System-Phase Diagram. 2
- Pattinson's Process-Desilverisation of Argenteferous lead. 2

ESSENTIAL READING:

1. Dr. OP Agarwal(Vol I to III). 2014 **Unified course in Chemistry**. Meerut: Jai Prakash Nath Publications.
2. K.L. Kapoor. 2002. **Textbook of Physical chemistry** -2nd Edition-Reprint--Vol. I,II,III.

SUGGESTED READING:

3. S. Glasstone 2006. **An Introduction to Electro Chemistry**. Delhi: Affiliated East-West Press (P) Ltd.
4. S.K.DograsDogra. 2004 **The Physical Chemistry through Problems**. Hyderabad: New Age International Publishers.
5. R.P.Rastogi &R.R.Misra. 2009. **An Introduction to Chemical Thermodynamics.** Chenni**:** Vikas (P)Ltd.
6. Arun Bahl B.S.Bahl, G.D.Tuli. 2012. **Essentials of physical chemistry** New Delhi: S.Chand& Company Ltd.
7. Puri Sharma & Pathania. 2016 **Principles of physical chemistry**. Jalandhar: Vishal Publishing Co.

CELL & MOLECULAR BIOLOGY PRACTICALS

Credits: 1 **Semester: I**
Subject Code: BT19105 **No. of Practical Hours: 30**

Objective:

- To understand the cellular components underlying mitotic cell division.
- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially membranes and organelles.

Outcome: Students will be able to perform different isolation techniques, to isolate DNA, RNA, chloroplast ,mitochondria or other organelles and to study cell division

1. Preparation of mitotic chromosomes. 2
2. Preparation of meiotic chromosomes from Maize/ Grasshopper. 2
3. Isolation of chloroplast from spinach leaves. 3
4. Isolation of Mitochondria from Plant material. 3
5. Identification of cell types 2
6. Electron Micrograph study of cell Organelles. 3

SUGGESTED READING:

1. Gerald Karp. 2013. **Cell and Molecular Biology**: Concepts and Experiments. U.S.A: Wiley Publishers.

GENETIC ANALYSIS PRACTICALS

Credits: 1 **Semester: I**
Subject Code: BT19106 **No. of Practical Hours: 30**

Objective: Students will be able to apply the knowledge gained in Mendelian principles of inheritance to problems of inheritance.

Outcome: Students will be able to culture the different types Drosophila stocks and solve the problems on Mendelian and Non-Mendelian inheritance.

1.	Maintenance and Culturing of drosophila stock	2
2.	Numerical Problems in Monohybrid / Dihybrid segregation	2
3.	Problems in Epistatic ratios.	2
4.	Study of Salivary gland chromosome in drosophila	2
5.	Problems in linkage and crossing over	2
6.	Problems in Tetrad analysis in Neurospora	2
7.	Screening for Barr bodies	3

SUGGESTED READING:

- Klug, S. William & Cummings, Michael R..1997. Concepts of Genetics. Hyderabad: BIOS Scientific Publishers Ltd.
- Peter, J. Russel .1996. Genetics. Noida: Harper Collins college Publishers.

BIOCHEMISTRY & METABOLISM PRACTICALS

Credits : 1 **Semester: I**
Subject Code : BT19107 **No. of Practical Hours: 30 .**

Objective:

- To define chemical or biochemical problems, then formulate hypotheses and design experiments to address them.
- To carry out experiments (follow directions, manipulate materials and lab apparatus, record data).
- To use modern instrumentation (prepare samples, operate systems, troubleshoot common problems, organize and label data).

Outcome: Student can analyze the concentrations of metabolites and get to assess the biochemical parameters involved in regulating a healthy body.

Introduction to Good Lab Practices	
Principles of Lab Hygiene and Safety	1
Qualitative identification of Carbohydrates – glucose, fructose, maltose, sucrose and starch	4
Qualitative identification of Amino acids – histidine, tyrosine, tryptophan, and cysteine .	2
Qualitative identification of Lipids – solubility, saponification, acrolein test, salkowski test, Lieberman – burchard test	2
Preparation of Osazones and their identification	2
Quantitative estimation of maltose by DNSA method.	1
Quantitative estimation of Protein by Biuret method.	1
Quantitative estimation of Nucleic acid.	1
Determination of Acid value of Fats.	1

SUGGESTED READING:

1. Sawhney S.K, Randhir Singh. 2007. **Introductory practical Biochemistry**. New Delhi. Narora: Publishing House.
2. Plummer D.T. 1988. **An introduction to practical Biochemistry**. New Delhi: III edition. Tata McGraw Hill.
3. Jayaraman. J. 1981. **Laboratory manual in Biochemistry**. New Delhi: I Edition Wiley. Eastern Limited.
4. Sashidhar Rao.B and Vijay Deshpande. 2007. **Experimental Biochemistry**. A student companion IK International pvt Ltd.

CHEMISTRY –I PRACTICALS

[SEMI MICRO ANALYSIS OF SIMPLE SALT]

Credits :1 **Semester: I**
Subject Code:BT19108 **No. of Practical Hours:30**

Objective: Students tends to learn qualitative analysis of ions present in given salt.

Outcome: Students can identify the acidic and basic radicals present in the given inorganic salt by semi micro analysis.

Laboratory Safety Rules and Regulations:
Minimizing Risks of Hazards, Personal protective Equipment (PPE) – Hair, Dressing for the Laboratory Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills. Use of fire extinguisher and first aid kit in laboratory safety symbols.
1
[SUBMISSION OF ASSIGNEMT]

SEMI MICRO SALT ANALYSIS (WATER SOLUBLE/INSOLUBLE)

Theory behind Semi Micro Analysis-Definition, Principles & Reactions involved. 1
Demonstration of Semi Micro Analysis of Ions. 1

ANALYSIS OF :
(3)$CaCO_3$ 1
(4)$Al_2(SO_4)_3$ 1
(5)$Sr(NO_3)_2$ 1
(6)$Ba(NO_3)_2$ 1
(7)$BaCl_2$
1
(8)$Zn_3(BO_3)_2$
1
(9)$Pb(CH_3COO)_2$
1
(10)$Ca(CH_3COO)_2$
1
(11)NH_4Cl
1
(12)$Bi(NO_3)_3$
1
(13)$Cd(NO_3)_2$ 1
(14)Discussion of VIVA Questions. 1

ESSENTIAL READING:
G.Svehla. 2002. **Vogel's Qualitative Inorganic Analysis.** 7th Edition. New Jersey: Pearson.

Semester - II

YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
B.Sc. BIOTECHNOLOGY, CHEMISTRY & GENETICS
SECOND SEMESTER
ACADEMIC YEAR 2021-22 OF 2021-24 BATCH (CBCS)

S. No.	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
THEORY									
1	I	EN18201	General English-II **(AECC-3)**	3	3	40	60	100	3
2	I	IC19201	Indian Heritage & Culture **(AECC-4)**	2	3	40	60	100	2
3	II	BT19201	Molecular Genetics **(GE-2)**	5	3	40	60	100	4
4	II	BT19202	Microbial Genetics **(CORE-4)**	4	3	40	60	100	4
5	II	BT19203	Immunology **(CORE-5)**	4	3	40	60	100	4
6	II	BT19204	Chemistry-II **(CORE-6)**	5	3	40	60	100	4
PRACTICALS									
7	II	BT19205	Microbial Genetics (**CORE-4**)	2	3	40	60	100	1
8	II	BT19206	Immunology **(CORE-5)**	2	3	40	60	100	1
9	II	BS19207	Chemistry-II **(CORE-6)**	2	3	40	60	100	1
10	III	PL18001	PLANET* (Outreach)						1
Total				**29**		**360**	**540**	**900**	**25**

*AECC Ability Enhancement Compulsory Course
* GE Generic Elective

GENERAL ENGLISH -II

Credits: 3 **Semester: II**

Subject Code: EN18201 **No of Lecture Hours: 45Hrs**

Objectives:

- To enhance the learners' communication skills by giving adequate exposure in reading, writing, listening and speaking skills and the related sub-skills.
- To develop oral and written communicative skills among the students so that their employability enhances and English becomes the medium of their livelihood and personality.

Outcome: Students will be able to improve Language in a holistic way through application, differentiation, organization and creation of their own composition in writing skills.

UNIT- I **9Hrs**

Biography

From the text "Mokshagundam Visvesvaraya"
Explanation of the text, 2

- Grammar –---- Conjunctions, Adverbs 2
- Vocabulary ----- Prefixes and Suffixes 2
- Writing Skill ------Paragraph Writing 2
- Speaking Skill—Role Plays 1

UNIT-II **9Hrs**

Health

From the text "Three Days to See"
Explanation of the text 1

- Grammar -------Usage of Modal Auxiliary Verbs 2
- Vocabulary --- Collective Nouns ,Technical Vocabulary 2
- Writing Skill ------Report Writing 2
- Speaking Skill -----Jam 2

UNIT-III **9Hrs**

Short Story

From the text "Leela's Friend" by R.K.Narayan

- Explanation of the text 2
- Grammar----Phrasal Verbs, Wh- Questions 2
- Vocabulary----Noun and Verb Suffixes 2
- Writing Skill------Writing a Narrative 2
- Speaking Skill --Debates 1

UNIT-IV **9Hrs**

Inspiration

From the text "The Last Leaf" by O. Henry

- Explanation of the text 2
- Grammar----- Prepositions 2
- Vocabulary-----Idioms 2
- Writing Skill----- Précis Writing 2
- Speaking Skill--- Presentations 1

UNIT-V **9Hrs**

Human Interest

From the text" The Convocation Speech"
Explanation of the text 2

- Grammar---- Active and Passive Voice 2
- Vocabulary-----One-word Substitutes 2

- Writing skill------ Essay Writing 2
- Speaking Skill---- Group Discussion 1

ESSENTIAL READING:

Epitome of Wisdom, Maruthi Publications.

SUGGESTED READING:

1. Krishna Mohan and Meera Banerjee. **Developing Communication Skills**. 1990. New Delhi. Macmillan India Ltd..
2. Krishnaswamy.N. and Sriraman, T. **Current English for Colleges**. 1995. Madras Macmillan India Ltd.
3. Narayanaswamy, V.R.. **Strengthen Your Writing**. 1979. New Delhi. Orient Longman.
4. Sharma, R.C. and Krishna Mohan. **Business Correspondence**. 1978. New Delhi. Tata McGraw-Hill Publishing Co.

INDIAN HERITAGE & CULTURE

Credits : 2 **Semester : II**
Course Code : IC19201 **No. of lecture hours: 30**

Objectives:

- To apprise the students with a sound background of Indian Culture.
- To equip the students with social & community problems of India.
- To prepare the student for civil service exams where Indian Heritage & Culture paper is compulsory for all the streams.

Outcome:

- Student will have knowledge about Indian Customs and Traditions.
- Student can make use of the subject knowledge to attempt all kinds of competitive exams especially civil services.
- The Subject helps the student community to have knowledge of historical and contemporary social, religious and political issues of the nation.

UNIT I **6 Hrs**

INTRODUCTION – IMPACT OF GEOGRAPHY ON INDIAN CULTURE

- Meaning of culture – Characteristics of Indian Culture and Caste system
- Indus Valley Civilization and Vedic/Aryan Culture
- Golden Age of Indian Culture– Mauryas and Guptas, Satavahavas, Pallavas, Cholas.

UNIT II **6 Hrs**

MEDIEVAL INDIA – INFLUENCE OF ISLAM ON INDIAN CULTURE

- Cultural Development under the Delhi Sultanate and Mughals
- Contribution of Sher Shah and Akbar to Indian Administrative System
- Cultural Achievements of Kakatiya and Vijayanagara rulers
- Indian Fine Arts –Painting, Music, Dance and Sculpture

UNIT III **6 Hrs**

IMPACT OF WEST AND REFORM MOVEMENTS

- Influence of Western culture on Indian Society
- 19th century Socio Religious Reform Movement –Raja Ram Mohan,Ishwara Chandra Vidyasagar and Veerasalingam
- Rise of Subaltern Movements in India– Jyothirao Phule-Savitribai Phule,E.V Ramaswamy Naikar –Narayana Guru-Dr.B.R.Ambedkar
- Rise of Indian National movement-Moderate, Extremist and Gandhian Era

UNIT IV **6 Hrs**

IMPACT OF RELIGION AND COSTITUTIONAL INSTITUTIONS

- Hinduism – Islam – Christianity – Jainism and Buddhism -Sikhism – Zoroastrianism
- Democratic system in India- -Parliament and Judiciary- Election Commission
- Impact of Press and Social Pressure groups on Indian Culture

1. Know your Rights – Classification of Rights and Importance

UNIT V **6 Hrs**

IMPACT OF CONTEMPORARY GENDER ISSUES

- Woman and Child rights- Violence against Women and Children
- Gender issues - LGBT
- Youth Unrest and Reasons- Alcoholism, Drug Addiction and other Addictions
- Terrorism – Causes and Consequences

REFERENCE BOOKS:

1. Jha, Dr K.N. 2006. **Studies in ancient & Medieval India**. COSMOS Book hive Ltd: Gurgaon.
2. Mahajan, V.D. 2008. **Ancient India**. S.Chand, New Delhi.
3. Manasseh, Dr P. 2010. **An Overview of Indian Culture**. Gamaleil Publishers, Hyderabad.
4. Malpani, Madanlal & Malpani, Shamsunder. 2014. **Indian Heritage and Culture**. Kalyani Publishers, Ludhiana.
5. Mhaske, Dr R.H. 2012. **Human Rights, Social Justice and Political Challenges**. Chandralok Prakashau, Kanpur.
6. Singh, Gurdip & Ahuja, V.K. 2012. **Human Rights in 21st Century**. Universal Law Publisher, New Delhi.

MOLECULAR GENETICS

Credits : 4 **Semester: II**
Subject Code : BT19201 **No of Lecture Hours: 75**

Objective: To provide the basic theoretical concepts and techniques of Molecular Biology
and provides knowledge of Genetics at molecular level.

Outcome: Student will be able to gain knowledge on the concepts of nucleic acid and their
role in gene expression.

Unit specific Outcomes:

- Understand the mechanism of DNA Replication, fundamentals of DNA damage and repair, including types of mutation and repair mechanisms
- Understand theTranscription and translation in prokaryotes
- Understand theTranscription and translation in eukaryotes
- Understand the concept of operon and its structure and regulation
- Understand the structure ,types of transposable element and mechanism of transposition

UNIT-I DNA REPLICATION, MUTATION, REPAIR 15Hrs

- DNA Replication-Linear DNA replication – Mechanism & Enzymes involved in DNA replication 3
- Circular DNA replication –Rolling circular model 1
- DNA Mutations –Spontaneous mutations –(Depurination ,Deamination) 1
- Induced mutations -Transition &Transversion,Frame- shift mutations, Silent mutations, Missense mutations ,Nonsense mutation 2
- TYPES OF MUTAGENS- Physical mutagens: Ionizing & non- Ionizing radiations , 2
- Chemical mutagens: Base analogues, Base-modifying agents, Alkylating agents &Intercalatingagents 3
- Types of DNA Repair-Photo reactivation, Excision repair, Recombination repair, SOS repair 3

UNIT II GENE EXPRESSION IN PROKARYOTES: 15 Hrs

- Central Dogma 1
- Structure of prokaryotic gene (promoter, initiator & terminator regions), 2
- Structure and functions of RNA polymerase 3
- Transcription mechanism- initiation, elongation & proof reading, termination (rho independent & rho dependent); 4
- Basic concept of reverse transcription 1
- Translation mechanism- initiation, elongation and termination 4

UNIT- III GENE EXPRESSION IN EUKARYOTES 15Hrs

- Structure of eukaryotic gene (promoter, exons, introns, terminator, enhancer & silencer) 2
- Transcriptional machinery in eukaryotes (RNA polymerases), 1
- Transcriptional factors (basic, upstream &regulatory) 1
- Transcription- initiation, elongation and termination 4
- Post-transcriptional modifications- capping, polyadenylation, Splicing 2
- Translation- initiation, elongation and termination 2
- Genetic code- properties, deciphering of genetic code, degeneracy of code ,wobble hypothesis,. 3

UNIT – IV REGULATION OF GENE EXPRESSION IN PROKARYOTES AND EUKARYOTES 15 Hrs

- Basic control circuits – operon concept 1
- Gene regulation: Negative & Positive control 2
- Inducible operon-Discovery of lac system,Catabolite repression of lac operon4
- Repressible operon-Tryptophan regulation – attenuation. 2
- Regulation by a cascade in phages – Lysogenic cascade, lytic cascade. 4
- Regulation of gene expression in eukaryotes- mating types in yeast 2

UNIT –V TRANSPOSABLE ELEMENTS 15 Hrs

- Physical structure of transposons, 2
- Mechanism of transposition. 3
- Bacterial Transposons –IS Elements 2
- Maize Transposable elements – Ac, Dc, 4
- Drosophila – Copia and p-elements. 2
- Yeast Ty elements. 2

SUGGESTED READING:

1. Benjamin Lewin. 2004. Genes VIII. Pearson Prentice Hall.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. 2007. Molecular Biology of the Cell. Garland Science
3. Friefelder David. 1987. Molecular Biology. 2nd Edition. USA. Jones & Bartlett Publishers,Inc .
4. Nelson D. L. and Cox, M. M. 2008. Lehninger. Principles of Biochemistry. 5th edition. W. H. Freeman.
5. Gerald Karp. 2013. Cell and Molecular Biology: Concepts and Experiments. Wiley

MICROBIAL GENETICS

Credits: 4 **Semester : II**
Subject Code: BT19202 **No. of Lecture Hours: 60**

Objectives: Students will be able to differentiate the micro organisms based on morphology and identify factors essential for the growth of micro-organisms.

Outcome: Students will be able to identify factors essential for the growth of micro-organisms and gain knowledge on various activities of micro-organisms that are beneficial to humans.

Unit specific Outcomes:

- Understand the scope, evolution and history of microbiology
- Understand Morphology and cell structure of major groups of microorganisms
- Understand theConcept, principle and types of sterilization methods
- Understand Concept of culture and type of culture media and Microbial growth
- Understandprinciples of fermentation and production of commercially important products

UNIT-I: HISTROY OF MICROBIOLOGY 12hrs

- Definition and scope of microbiology. 2
- Fundamentals of Microbiology 1
- Evolution of Microbiology 1
- History of microbiology: Contribution of Antony Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert koch, lwanoswky, Beijernik, Redi, Spallanzani, Needham, Tyndal, Joseph Lister and Alexander Fleming. 4
- Three and five kingdom classification 2

Unit - II FUNDAMENTALS OF MICROBIOLOGY 12hrs

- Various forms of microorganisms 1
- Concept of microbial species and strains 1
- Distribution and characterization of Prokaryotic cell, 2
- Distribution and characterization of Eukaryotic cell 2
- Differences between prokaryotic and eukaryotic cell 2
- Morphology and cell structure of major groups of microorganisms e.g. Bacteria, Blue green algae, Chlamydomonas, Fungi, Yeast 2
- Unique features of viruses.(TMV) 2

Unit -III STERILIZATION T EHNIQUES 12 hrs

- Sterilization and Disinfection Techniques 1
- Principle of sterilization 1
- Methods of sterilization-Physical methods-Heat sterilization –dry heat (red heat,flaming,Incineration,hot air) and moist heat (Tyndalization,Pasteurization,Autoclaving), 4
- Filter sterilization, Radiation methods-U.V rays, Gamma rays. 2
- Chemical methods-use of Alcohols, Aldehydes, Phenol, Halogens,Heavymetals,Dyes and Gas (ethylene oxide) 2
- Instruments-Autoclave,Hot air oven,Laminar air flow hood, Incubator 2

Unit –IV MICROBIAL GROWTH AND IDENTIFICATION OF BACTERIA 12hrs

- Cell culture media – defined , complex media , selective , differential media , minimal and enrichment media 2
- Microbial growth –Different Phases of Growth in Batch cultur ,Generation time 2
- factors affecting growth of bacteria. 1
- Nutritional classification of micro organisms 1
- Establishing a pure culture – streak plate , spread plate , pour plate 2
- Methods for measuring microbial growth –Direct count,Viable count,Most probable Number and Turbidimetric procedure 2
- Identification of bacteria - Simple staining,Differential Staining,Negative Staining, endospore staining and IMVIC test 2

Unit- V INDUSTRIAL MICROBIOLOGY 12hrs

- Definition and Principle of fermentation, 1
- primary and secondary metabolites, 1
- Types of fermentations -Batch,Continuous,Fed –Batch, solid state,surface fermentation and submerged fermentations. 1
- Feed-stocks for industrial fermentation: Molasses, corn steep liquor, whey, malt, yeast extract and antifoams. 1
- Production of lactic acid and ethanol 2
- Butyric acid and Mixed acid production 2
- Amino acid and propionic acid fermentation 2
- Fermentation of acetate to methane 2

SUGGESTED READING:

1.Pelczar M.J, Chan. E.C.S. 1997. Neol R .Krieg. Microbiology. NewDelhi: fifth edition; Tata McGraw Hill Publishing Company Ltd.
2.Powar and Daginawala. 2000. General Microbiology. Meerut: Vol 1 and Vo2 Himalaya Publishing House.
3.Prescott, Harley& Klein. 2007. Microbiology. New Delhi: Fourth edition Mc. Graw Hill
4.Ronald M Atlas. 1997. Principles of Microbiology. Second edition. Wm: C.Brown Publishers.

IMMUNOLOGY

Credits: 4 **Semester : II**
Subject Code: BT19203 **No. of Lecture Hours: 60**

Objectives:

- Students will learn fundamentals of immune system including cells and tissues of immune system molecular and cellular components of innate immunity and adaptive immunity.
- Learn to apply immunological knowledge to solve new problems.
- Become proficient with the use of major investigation tools of immunology.

Outcome: Students will be able to gain advanced knowledge of the underlying principles of immunology and its application in solving problems in biological systems.

Unit specific outcomes:

- students will be able to gain knowledge on concepts of nonspecific ,specific immunity,organs of immune system.
- students will be able to Identify the structure, function, and characteristics of immunoglobulins ,State the principle of the routine serologic procedures performed in the laboratory.
- students will gain an indepth understanding on antibody diversity ,Mab Production&applications
- students will be able to Demonstrate the relevance of immunity to infection and disease& gain basic knowledge on vaccines.
- students will be able to gain indepth knowledge on inflammation ,allergic reactions &autoimmunity

UNIT – I **12Hrs.**

- History and scope of immunology. 1
- Natural and acquired immunity. 2
- Cells of the immune system:
    1. Lymphoid cells (B Lymphoid cells, T Lymphoid cells and Null cells 2
    2. Mononuclear cells. 1
    3. Granulocytic cells (neutrophils, eosinophils and basophils) 1
    4. Mast cells and Dendritic cells. 1
- Organs of the immune system:
    1. Primary lymphoid organs – Thymus and Bone marrow. 2
    2. Secondary lymphoid organs – lymph nodes, spleen and malt 2

UNIT - II **12hrs.**

- Antigens -Antigenicity ,Immunogenecity,Properties of Antigen, Immunogenecity vs Antigenicity, factors affecting antigen,epitopes, Haptens & adjuvants. 2
- Structure of Immunoglobulin (Heavy chain,Light chain,Hinge region,Variable&constant domains-CDR,HVR,Idiotype,Isotype,Fab&Fc regions) 2
- Types and functions of immunoglobulins(IgG,IgM,IgA,IgE,IgD) 2
- Ag – Ab interactions.
    1. Precipitation. 1
    2. Agglutination. 1
    3. RIA. 1
    4. ELISA. 1
    5. Immunoprecipitation. 1
    6. Immunofluorescence. 1

UNIT – III **12hrs.**

- Organization & Expression of Immunoglobulin genes-Light & Heavy chain 2
- Generation of antibody diversity. 2
- Humoral Immunity (Neutralisation, complement mediated lysis ,Opsonisation,Phagocytosis) 2
- Cell mediated immune response –T-cell receptor(TCR,Peptide &MHC), Antigen presenting cells (APCs),Major Histocompatibility Complex (TypeI&II) 2
- Hybridoma technology:
    Mab production 2
    Applications of Mab(Dignosis,Therapy,Purification) 2

UNIT-IV **12hrs**

- Active and Passive immunization. 2
- Vaccines
- Conventional-Live attenuated&Heat killed 2
- Subunit vaccine-(Hepatitis B vaccine),Toxoid 2
- Recombinant vaccine-Recombinant vector vaccine. 2
-

- Immunity to infectious agents: 4
  1. Bacterial infections.
  2. Viral infections.
  3. Protozoan infections.

UNIT – V **12hrs**

- Hypersensitivity
  TYPE – I: IgE mediated (Asthma,Atopy,Anaphylaxis) 2
  TYPE - II :Antibody Mediated (Autohemolytic Anemia,ErythroblastFoetalis)2
  TYPE – III:Immune complex Mediated(Arthus reaction,Serum sickness) 2
  TYPE – IV:Cell mediated (Contact dermatitis,Tuberculin Reaction) 2
- *Autoimmune diseases* :
  1. Organ specific:
  Hashimotothyroiditis,Myesthiniagravis,Diabetes(IDDM),Graves disease 2
  2. Systemic-:
  Systemic Lupus Erythematosus, Rheumatoid arthritis. 2

SUGGESTED READING:

1. Kuby. 2007. **Immunology.** Newyork. W.H.Freeman and company.
2. Ivan.M.Roitt and Peter.J.Delves. 2005. **Essential Immunlogy**. Massachusetts. Blackwell Publishng company.
3. Dulsy Fatima and N.Arumugam. 1994. **Immunology.** Kanyakumari. Saras publication.

CHEMISTRY-II

Credits : 4 **Semester: II**
Subject Code:BT19204 **No. of Lecture Hours:75**

Objective: To develop an understanding of basic concepts in Inorganic & Organic Chemistry.

Outcome: Students will be able to gain the fundamentals of Organic Chemistry.

Unit Specific Outcomes :

- Analyze the structures and stability of various molecules/ions
- Understand the synthesis & structures of compounds of P-Block elements
- Understand the synthesis & structures of compounds of P-Block elements
- Understand the fundamentals of organic molecular structures
- Understand the fundamentals of organic molecular structures .

UNIT -I **15Hrs**
Atomic Structure & Chemical Bonding
.

- Blackbody radiation – energy distribution, Photo Electric Effect. 3
- De Broglies Hypothesis, Heisenberg's Uncertainty Principle, problems. 2
- Schrodinger's Wave equation, Hamiltonian Operator. 2
- Bond Polarization – Fajan's rules – applications. 2
- MOT - LCAO Concept – Types of MO's ; Mixing up of orbitals. 2
- MOED's for (i) Homo atomic molecules/ions – $H_{2,,}$ He_2 N_2, O_2 .
- (ii) Hetero atomic molecules/ions – CO, CN^-, NO, HF - Bond order, Stability and magnetic properties. 4

UNIT -II **15Hrs**
P – Block Elements-I

- Hydrides – synthesis, structure of B_2H_6 and B_4H_{10} 2
- Halides –Relative Lewis acidity of BX_3(BF_3, BCl_3,BBr_3& BI_3) 2
- Carboranes - Definition, Classification (closo, nido)- Preparation and structure of Borazole 2
- Oxides – Classification (i)Normal (acidic, basic, amphoteric & neutral)(ii) mixed (iii) suboxides(iv)peroxides (v) superoxides with suitable examples.2
- Acidity & structures of Oxides of N, P, S & Cl. 3

- Oxy Acids-Acidity and structures of oxy acids of N, P 2
- Acidity and structures of oxy acids of S, Cl 2

UNIT-III **15Hrs**

P-Block Elements-II

- Carbonyls – Definition, classification (Mono, Polynuclear), Preparation, structure & bonding In (i) $[Ni(CO)_4]$ (ii)$[Fe(CO)_5]$ (iii) $[Co_2(CO)_8]$. 3
- Inter halogens – Preparation, Structures of (i) AB(ICl, ClF)
  (ii) AB_3 (ICl_3,ClF_3) 2
  (iii) AB_5 (IF_5) (iv) AB_7(IF_7) .
- Poly halides – Definition and structures of (i) I_3^- (ii) ICl_2^- (iii) ICl_4^- (iv)ICl_2^+ (v) ICl_4^+ 2

- Pseudohalides & Pseudohalogens – Examples, comparison with halides & halogens. 2

- Xenon compounds – Preparation, structures of
  (i) XeF_2 (ii) XeF_4(iii) XeF_6 (iv) $XeOF_4$(v) XeO_2F_2 3
  (vi) $XeOF_2$ (vii) XeO_3(viii) XeO_4 . 3

UNIT-IV **15Hrs**

Bond Polarization

- Covalent nature of Organic Compounds, types of bond fission and organic reagents (Electrophilic, Nucleophilic & free radical reagents) 1

- Bond Polarization – Factors influencing the polarization of covalent bonds, Inductive Effect –application of IE (i) basisity of amines (ii) acidity of carboxylic acids (iii) Stability of carbonium ions. 3
- Resonance (or) Mesomeric Effect – applications to (i) acidity of Phenol (ii)acidity of Carboxylic acids. 3
- Orientation Effect on aromatic substitution – Ortho, para & meta directing groups (i) -Cl, -OH, $-NH_2$, $-CH_3$ (ii) $-NO_2$,>CO, -COOH, -CN. 2
- Electromeric Effect – Definition & examples. Hyperconjugation – application to Stability of(i) Carbonium ions (ii) Free radicals & (iii) Alkenes. 2
- Organic reaction intermediates-Definition, generation and stability of carbocations, carbanions, carbon free radicals. Definition and example for carbene. 2

Aromaticity

- Concept of Aromaticity :- Definition, Huckel's rule application to (i) Benzenoid – (Benzene, Naphthalene, Anthracene & Phenanthracene (ii) Non-Benzenoid compounds Cyclopropenylcation, Cyclopentadienyl anion & Tropeliumcation. Anti aromaticity-1,3,5,7-octa tetraene. 2

UNIT-V **15Hrs**

Reaction Mechanisms & Halogen Compounds

- TYPES OF ORGANIC REACTIONS – Substitution (free radical, electrophilic &nucleophlic), Addition (free radical, electrophilic & nucleophilic) Elimination reactions Molecular rearrangements with suitable examples. 2
- MECHANISMS -(i) Free radical substation reaction – Chlorination of Methane. 1
- (ii)S_E – (a) Chlorination (b) Nitration (c) Friedel Craft's alkylation (d) Friedel Craft's acylation (e) Sulphonation of Benzene. 2
- (iii) S_N : (a) S_N1 - Hydrolysis of t-C_4H_9Br (b)S_N2 - Hydrolysis of n-C_4H_9Br; Distinction between Transition state & reaction intermediate. 2
- (iv) Electrophilic addition (a) CH_3-CH=CH_2 + Br_2
  - (b) CH_3-CH=CH_2 +HBr 1
- (v) Free radical addition CH_3-CH=CH_2 +HBr
  - (in presence of -O-O-). 1
- (vii) Nucleophilic Addition Reaction [CH_3CHO + HCN]
- (vii) Elimination Reactions (E_1- n- C_4H_9Br + KOHalc) &
- (E_2 – t-C_4H_9Br + KOH_{alc}). 1

Halogen Compounds

- Classification – Alkyl Halides (1^0, 2^0 and 3^0) Aryl Halides, Aralkyl Halides, Allyl Halides and Vinyl Halides. Nomenclature, Isomerism. 1
- Preparation methods for alkyl halides – (i)from alkanes, (ii)from alkenes, (iii)from alcohols (a) using HX/$ZnCl_2$, (b)using PCl_5 (or)PCl_3 (c)$SOCl_2$, (iv)Hunsdiecker reaction(Mechanism). 1

- Properties –(i)Reduction, (ii) S_N :- (a)aq.KOH, (b)EtoNa, (c)NH_3, (d)CH_3COOAg,(e)KCN, (f)AgCN, (g)KONO, 1
  (h)AgONO. (iii)Elimination reaction – alc.KOH, (iv)Metals – (a)Na/dry ether, (b)Mg/ether. 1

- Stereochemistry of S_N1 & S_N2 Mechanisms taking an example of 2-Bromo butane(2^0 alkyl halide). .

- Ease of hydrolysis- comparison benzyl halides, allyl halides & vinyl halides with alkyl halides. 1

ESSENTIAL READING:

1. Unified course in chemistry. 2014. Dr. O.P. Agarwal (vol1,2,3). Meerut.
   Jai Prakash Nath publication.

SUGGESTED READING:

1. R.T. Morrison and R.N. Boyd. 2010. **Organic Chemistry.** UK. Replicka Press (P) Ltd.
2. Arun Bhal & Bhal. 2005. **Organic chemistry**. 6th addition. New Delhi. S.Chand & Co.
2. Jerry March. 2015. **Advanced organic chemistry**. 4th edition. Sonipat. Replika Press (p) Ltd.
3. R.K. Bansal. 2007. **Text book of organic chemistry**. New Delhi. New Age Publications.
4. J.D. Lee. 2008. **Concise Inorganic Chemistry.** New Delhi. Wiley India Ltd.
5. Madan Malik and Tuli. 2010. **Selected Topics In Inorganic Chemistry**. New Delhi. S. Chand Company Ltd.
6. F.A. Cotton and G.WilkinsonCaros A MarilloBochmann. 1999. **Advanced Inorganic Chemistry**. 6th edition. New Delhi. Wiley India Education.

MICROBIAL GENETICS PRACTICALS

Credits:1 **Semester : II**
Subject Code: BT19205 **No. of Lecture Hours:30**

Objectives: Students will be able to differentiate and identify & isolate microorganisms.

Outcome: Students will be able to understand isolation & culturing of microorganisms.

1.	Rules to be followed in microbiology Laboratory.	1
2.	Microscopy.	1
3.	Sterilization techniques: Autoclave, Hot air oven and filtration.	2
4.	Preparation of microbiological media .	2
5.	Pure culture techniques – Streak plate, Spread plate and pour plate.	2
6.	Isolation of microorganism from water,air,soil samples.	2
7.	Gram staining method.	1
8.	Growth curve in microorganisms.	3
9.	Antibiotic sensitivity of microbes – Use of antibiotic discs.	1

SUGGESTED READING:

1. Pelczar M.J, Chan. E.C.S. 1997. Neol R .Krieg. **Microbiology**. NewDelhi: fifth edition; Tata McGraw Hill Publishing Company Ltd.
2. Powar and Daginawala. 2000. **General Microbiology.** Meerut: Vol 1 and Vo2 Himalaya Publishing House.

IMMUNOLOGY PRACTICALS

Credits: 1 **Semester : II**
Subject Code: BT19206 **No. of Practical Hours: 30**
Objective:
The objective is to familiarize students with the various immunological techniques that include antigen-antibody interactions, quantization of antigens or antibody, ELISA, agglutination reactions etc.
Outcome:
Students will be able to develop a comprehensive and practical understanding of basic immunological principles involved in research and clinical/applied science.

- Radial Immuno diffusion. (2)
- Ouchterlony double diffusion (Antibody titration). (2)
- Ouchterlony double diffusion(Antigen- Antibody titration). (2)
- Rocket immuno electrophoresis. (2)
- Counter current immuno electrophoresis. (2)
- Latex agglutination. (1)
- Immuno electrophoresis. (2)
- Gel filteration demonstration. (1)
- ELISA demonstration. (1)

SUGGESTED READING:

Richard. L. Myers. 1994. **Laboratory Manual for Immunology**. Hyderabad: MC Graw Hill Publications.

CHEMISTRY-II PRACTICALS

Credits:1 **Semester: II**
Subject Code:BT19207 **No. of Practical Hours :30**

[SEMI MICRO QUALITATIVE ANALYSIS OF MIXTURE OF INORGANIC SALTS]

Objective: Students tends to learn qualitative analysis of ions in given mixture of ions.
Theory behind Mixture Analysis- Reactions, Principles, Common Ion effect, Solubility products, Elimination of ions.
Outcome: Students will be able to identify various radicals in a given mixture.
Preparation of Lab Reagents:
Ammonium Hydroxide solution, Sodium Hydroxide solution, Sodium Carbonate solution, Silver nitrate solution, Ferric Chloride solution, Ferrous Sulfate solution, Nessler's reagent, Neutral Ferric Chloride solution, Ammonium Molybdate reagent, Ammonium Hydrogen Phosphate solution. [Minor Experiment] 1
Demonstration of elimination of ions from mixture. 1

SEMI MICRO MIXTURE ANALYSIS OF :

1. Cl^-, SO_4^{-2}, Ca^{+2}, K^+, 1
2. NO_3^-, CH_3COO^-, Cd^{+2}, Ca^{+2} 1
3. CO_3^{-2}, NO_3^-, Bi^{+3}, Ca^{+2} 1
4. Br^-, SO_4^{-2}, NH_4^+, Al^{+3} 1
5. CO_3^{-3}, NO_3^-, NH_4^+, Pb^{+2} 1
6. NO_3^-, CH_3COO^-, Zn^{+2}, Ba^{+2} 1
7. NO_3^-, CH_3COO^-, Pb^{+2}, K^+ 1
8. CO_3^{-2}, BO_3^{-3}, NH_4^+, Zn^{+2} 1
9. Cl^-, CH_3COO^-, NH_4^+, Ca^{+2} 1
10. CO_3^{-2}, Cl^-, Sr^{+2}, Mg^{+2} 1
11. CH_3COO^-, SO_4^{-2}, Mn^{+2}, Mg^{+2} 1
12. CO_3^{-2}, Br^-, Ba^{+2}, K^+ 1
13. Viva Questions 1

ESSENTIAL READING:

G.Svehla. 2002 **Vogel's Qualitative Inorganic Analysis.** New York: 7th Edition. Pearson.

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G.Svehla. 2002 **Vogel's Qualitative Inorganic Analysis.** New York: 7th Edition. Pearson.

LOYOLA ACADEMY
DEPARTMENT OF
B.Sc. BIOTECHNOLOGY, CHEMISTRY & GENETICS
BRIDGE COURSE-2021-22

FUNDAMENTALS OF CHEMISTRY

UNIT-I

- Importance of chemistry in Biological Sciences.
- Periodic Properties of elements (group wise)
- Stoichiometry - Determination of Oxidation states, Balancing chemical equations by (a) Ion electron (b) oxidation number methods

UNIT-II

- Types of Chemical Bonds – Covalent, Ionic, metallic Bonds
- Valence Bond Theory-Concept of Hybridization with examples : (i) sp (ii) sp^2 (iii)sp^3 (iv) sp^3d (v) sp^3d

UNIT-III

- Definition of Organic Chemistry and role of organic compound in life
- Differences between organic and inorganic compound
- Unique nature of **carbon** among all elements of Periodic table
- Concept of catenation in organic compounds
- Types of bonds observed in organic compound (σ, π)

UNIT-IV

- IUPAC Nomenclature for organic compounds
- Organic acid and bases – examples
- Criteria of acidity and basisity
- Effect of Inter & Intra molecular hydrogen bonding in organic compounds with examples
- Concept of Resonance – (i) Definition
  (ii) Explanation of Rules with examples

UNIT-V

- Expression of concentration and estimation of amount of substances in given volume of solution
- P^H Scale
- Calculation of P^H for (i) strong & weak acid (ii) strong & weak bases
  (iii) Mixture of acid and base (strong or weak)
  (iv)Buffer solution – Definition, calculation of P^H

Recommended Books:

1. Dr. O. P. Agarwal (vol I & III)2014 Unified Course in Chemistry Meerat: Jai Prakash Nath Publications
2. Arun Bahl B. S. Bahl, G. D. Tuli 2012 Essentials of Physical chemistry New Delhi: S. Chand & Company Ltd
3. S. N. Sanyal(4th Edition) 2019 Reactions, Rearrangements & Reagents Barati Bhawan Publications & Distributors

SEMESTER - III