ANNAMALAI UNIVERSITY
BACHELOR OF SCIENCE
B.Sc. CHEMISTRY DEGREE COURSE
(2021 - 2022)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components / Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
							CIA	Uni. Exam	Total
		SEMESTER I					CIA	Uni. Exam	Total
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3	III	Core Theory	Paper-1	6	4	General Chemistry - I	25	75	100
4	III	Core Practical	Practical-1	3	0	Volumetric Analysis	0	0	0
5	III	Allied -1	Paper-1	4	3	(Choose any 1 out of 5) 1. Physics I 2. Botany I 3. Zoology I 4. Biochemistry I 5. Mathematics I*	25	75	100
6	III	Allied- 1	Practical-1	3	0		0	0	0
7	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
8	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II					CIA	Uni. Exam	Total
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English (CE)	Paper-2	6	4	**Communicative English II**	25	75	100
10	III	Core Theory	Paper-2	5	4	General Chemistry - II	25	75	100
11	III	Core Practical	Practical-1	3	2	Volumetric Analysis	25	75	100
12	III	Allied-1	Paper-2	4	3	(Choose any 1 out of 5) 1. Physics II 2. Botany II 3. Zoology II 4. Biochemistry II 5. Mathematics II*	25	75	100
13	III	Allied Practical - 1	Practical-1	2	2		25	75	100
14	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15	IV	Value Education		2	2		25	75	100
16	IV	Soft Skill		2	1		25	75	100
		Sem. Total		**36**	**25**		**225**	**675**	**900**

* **Allied Mathematics**:

	Ins. Hrs/Week	Credit	CIA	University	Total Marks
Paper-1	6	3	25	75	100
Paper-2	6	5	25	75	100

ANNAMALAI UNIVERSITY

B.Sc., CHEMISTRY
SYLLABUS
UNDER CBCS
(2021 - 2022)

SEMESTER I
PAPER – 1
GENERAL CHEMISTRY – I

Objective:

Basic concepts regarding Atomic Structure, Periodic Properties, Bonding Concepts, Ionic Bond, VSEPR and MO Theories, Nomenclature of Organic Compounds, Hybridisation, Reaction Intermediates, States of Matter, Principle of Volumetric Analysis, Related Problems and Applications wherever necessary are to be taught for I- Semester.

Course Outcomes:

Upon completion of this course, the students will be able to

1) Recollect the Chemistry of Quantum Numbers.

2) Review and apply periodicity of properties.

3) Discuss various types of bonding through VB & MO theories.

4) Name simple Aliphatic and Aromatic Compounds.

5) Illustrate and apply electron displacement effects and reaction mechanisms.

6) Elaborate the basic concepts of solid, liquid and gaseous states.

7) Apply the principles of Volumetric Analysis.

UNIT-I ATOMIC STRUCTURE

1.1 Quantum numbers n, l, m and s – Pauli's exclusion principle – Energy distribution and orbitals - Hund's rule of maximum multiplicity - Aufbau's principle – Electronic Configuration of elements - Stability of Half-filled and completely filled orbitals. Shapes of s, p, d and f orbitals.

1.2 Classification of elements – General characteristics of s, p, d and f- Block elements – Periodicity of properties- Definition and Periodicity of the following properties – Atomic radii and Ionic radii - Factors affecting the Atomic radii and Ionic radii.

1.3 Ionisation potential, Electron affinity and Electronegativity - Factors affecting the Ionisation potential, Electron affinity and Electronegativity – Pauling scale – Mulliken electronegativity scale – Applications of Electronegativity regarding the Bonding nature. Trends in periodic table and applications in predicting and explaining the chemical behavior.

UNIT- II CHEMICAL BONDING

2.1 Ionic bond - Conditions for the formation of ionic bond - General properties – Energetics of formation of NaCl from Na^+ and Cl^- - Hydration energy, Lattice energy and their applications – Born-Haber cycle - Polarisation of ions- Fajan's rule - Transition from ionic to covalent character.

2.2 Covalent bond - Conditions for the formation of covalent bond - General properties - Polarity of bonds - Orbital overlap - Bond lengths and Bond energies - Hybridisation - Sigma and Pi bonds - VSEPR theory - Geometries of $BeCl_2$, BF_3, NH_3, CH_4, SF_4, ICl_2^-, H_2O, PCl_5, ClF_3, XeF_6, SF_6 and IF_7 molecules - Partial ionic character of covalent bond - Percentage of ionic character from dipole moment and electronegativity difference.

2.3 Molecular Orbital theory – Bonding and Anti-bonding orbitals - Relative order of

Energies of molecular orbitals - MO diagram of H_2, He_2, O_2, O^{2+}, O^{2-}, N_2, F_2, HF and CO - Bond Order - Stability and Magnetic properties of the molecules - Comparison of VB and MO theories. Hydrogen bonding-types, examples and effect on properties.

UNIT- III BASIC CONCEPTS OF ORGANIC CHEMISTRY

3.1 Classification of Organic Compounds – Nomenclature of Organic Compounds –

Functional Groups - Homologous Series - IUPAC Recommendations for Naming Simple Aliphatic and Alicyclic Compounds.

3.2 Basic concepts of bonding in organic chemistry - Hybridisation – Definition – Geometry of Molecules - Methane, Ethane, Ethylene, Acetylene and Benzene - Electron displacement effects - Inductive - Inductomeric - Electromeric – Mesomeric Effect - Resonance - Hyperconjugation and Steric Effects.

3.3 Cleavage of bonds - Homolytic and Heterolytic fission of carbon-carbon bond – Methods to determine the Reaction Mechanism - Reaction intermediates - Structure and Stability of Carbocations, Carbanions and Free radicals.

UNIT-IV STATES OF MATTER

4.1 Gaseous state - Kinetic gas equation - Postulates and Derivation - Gas laws from the kinetic gas equation - Kinds of velocities - Mean, RMS, Most Probable Velocities - Calculation of molecular velocities - Maxwell's distribution of Molecular Velocities (No derivation) - Effect of Temperature on velocity distribution - Equipartition of energy - Heat capacity on molecular basis - Virial equation of state - Boyle temperature - Coefficient of Compressibility and Thermal expansion.

4.2 Liquid state - Density – Diffusion - Viscosity – Evaporation - Surface tension Determination using Stalagmometer - Effect of temperature on surface tension - Parachor - Definition and Applications only - Coefficient of Viscosity- determination using Oswald's Viscometer- Effect of Temperature and Pressure - Liquid crystals - Classification and Applications.

4.3 Solid State - Crystal lattices - Symmetry elements in crystals - Unit cell- Seven crystal systems - Space lattice - Bravais lattices - Laws of Crystallography-law of constancy of inter facial angles and Rational Indices- Miller indices, X-ray diffraction by crystals.

UNIT-V PRINCIPLES OF VOLUMETRIC ANALYSIS
5.1 Definitions of Molarity, Molality, Normality and Mole Fraction – Their Calculations - Definition and Examples for Primary and Secondary standards - Calculation of Equivalent Weight of Acid, Base, Oxidising Agent, Reducing Agent and Salts.

5.2 Principles of Volumetric Analysis - Theories of Acid- Base, Redox, precipitation titrations, Complexometric Iodometric and Iodimetric titrations.

5.3 Theories of indicators- Choice of indicators - Acid-base indicators - Redox, Metal ion and Adsorption indicators.

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(to choose one out of 5)
PAPER-1

1. PHYSICS I

Course Objectives

1. To understand the basics of gravitation and to study the properties of matter.
2. To learn the law of thermoelectric circuits and thermoelectric diagrams.
3. To teach the growth and decay of a transient current and magnetometer.
4. To explain production of ultrasonics and reverberation time.
5. To know the basics of laser and fibre optics principles and applications.

UNIT-1: Properties of Matter

Gravitation: Acceleration due to gravity -Determination of 'g' by Simple pendulum - Drawbacks of simple pendulum –Determination of time period of compound pendulum - 'g' by compound pendulum -Centre of Oscillation and Centre of Suspension are interchangeable-Determination of 'g' by Bar/compound pendulum.

Elasticity: Bending of beams -Expression for bending moment - Cantilever Depression at the loaded end of a cantilever Expression forYoung's modulus -non–uniform bending-Pin and microscope method.

Torsion : Torsion couple – Potential energy in a twisted wire – Torsional pendulum – Time period - Determination of rigidity modulus by Torsional oscillation (without masses).

Viscosity: Viscosity of a liquid -Viscous force - Co-efficient of viscosity of a liquid – Poiseuille's formula -Experimental method using Burette- Effect of temperature and pressure on viscosity-applications.

Surface Tension: Surface tension of a liquid-Surface Tension and interfacial surface tension by the method of drops-applications.

UNIT-2: Thermo Electricity

Seeback, Peltier and Thomson effects - laws of thermoelectric circuits -Peltier coefficient - Thomson coefficient -application of thermodynamics to a thermocouple and expressions for Peltier and Thomson coefficients -thermo electric power and thermo electric diagrams.

UNIT-3: Transient Current and Magnetism

Growth and decay of current in a circuit containing resistance and inductance- Growth and decay of charge in circuit containing resistance and capacitor - growth and decay of charge in a LCR circuit – condition for the discharge to be oscillatory – frequency of oscillation.

Magnetism -Magnetic moment and pole strength of a magnet – Deflection magnetometer – Tan C

Position- Vibration magnetometer – Theory – Period of Oscillation – Determination of M and B_H using the deflection magnetometer and the vibration magnetometer .

UNIT -4: Acoustics

Sound: Transverse vibration of strings -Velocity and frequency of vibrations of a stretched string - laws -Sonometer -A.C. Frequency - Steel wire- Brass wire.

Introduction to Ultrasonics – Piezo electric effect–production by Piezo electric method – properties –applications- Acoustics of buildings – reverberation time – derivation of Sabine's formula – determination of absorption coefficient-Acoustic aspects of halls and auditoria.

UNIT-5:Lasers and Fibre Optics

Laser: Introduction - Principles of laser -Einstein's explanation for stimulatedemission – Differences between stimulated and spontaneous emission - Population inversion –Properties of laser -Types of lasers - He- Ne Laser - Semiconductor Laser-Applications of laser.

Fibre optics: Basic principle of an optical fibre -Total internal reflection -Basic structure of an optical fibre -Numerical aperture –Coherent bundle – Attenuation and dispersion - classification of optical fibres-step index and graded index fibers – single mode and multi mode fibers-Fibre optic communication system block diagram.-applications.

Text Books

Unit 1 and Unit 4

1. R. Murugesan and KiruthigaSivaprasath, Properties of Matter and Acoustics, S. Chand & Co. New Delhi, Kindle edition.

Unit 2 and Unit 3

1. R. Murugesan, Electricity & Magnetism, S. Chand & Co. New Delhi, 2019.

Unit 5

1. N Subrahmanyam, BrijLal and M.N Avadhanulu, A Text Book of Optics, S. Chand &Co. New Delhi, Revised Edition as per UGC model syllabus.

Reference Books

1. BrijLal and N Subrahmanyam,Electricity and Magnetism, S Chand & Company Pvt Ltd, New Delhi, 2000.
2. D.C. Tayal, Electricity and Magnetism, Himalaya Publishing House,Bombay, 2014.
3. BrijLal and N.Subrahmanyam, A Text Book of Sound,Vikas Publications, New Delhi (2 Edition)

4. C.L.Arora, Physics for Degree Students B.Sc First Year, S. Chand Publishing, 2013.
5. K.Thyagarajan and Ajay Ghatak, Introduction to Fibre optics-, Cambridge University.
6. Ajay Ghatak and K.Thyagarajan, Fiber optics and Lasers-The two revolutions, Macmillan, 2006.
7. K.Thyagarajan and Ajay Ghatak, Lasers; Fundamentals and applications, Springer.
8. Modern Physics – R,Murugeshan, KiruthigaSivaprasath, S.Chand&Co, New Delhi, 2016.

E-MATERIALS

1. https://courses.lumenlearning.com/physics/chapter/16-4-the-simple-pendulum/
2. https://www.youtube.com/watch?v=aw0_seEt4v0
3. https://en.wikipedia.org/wiki/Thermoelectric_effect
4. https://www.youtube.com/watch?v=S0I37M2sx_0
5. https://physicscatalyst.com/elecmagnetism/growth-and-delay-charge-R-C-circuit.php
6. https://www.youtube.com/watch?v=PLQQPXot6vE
7. https://www.youtube.com/watch?v=d0_Eff4MXwM
8. https://www.techglads.com/cse/sem1/production-of-ultrasonics-by-piezoelectric-methods/
9. https://thefactfactor.com/facts/pure_science/physics/optical-fibre/5159/
10. https://www.youtube.com/watch?v=auk1OS0SVWc (Tamil video)

Course Objectives

1. After studied unit-1, the student will be able to find the acceleration due to gravity at a place using simple pendulum and compound pendulum. Also can know the properties of matter like elasticity, viscosity and surface tension.
2. After studied unit-2, the student will be able to learn thermo emf using Seebeck and Peltier effects and hence understand thermoelectric circuits.
3. After studied unit-3, the student will be able to explain growth and decay of a transient current in a circuit containing resistance-inductance, resistance-capacitance and LCR in series. Also will be able to determine the horizontal components of earth's magnetic induction at a place using deflection magnetometer in Tan C position.
4. After studied unit-4, the student will be able to derive the expression for the velocity of a sound in a stretched string and hence they can determine the frequency of A.C mains.
5. After studied unit-5, the student will be able to understanding the principle of laser and can demonstrate the working of He-Ne laser and applications of laser. Also, the student will be able to learn the fibre optics, structure and application in communication.

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PAPER-1

2. BOTANY - I

UNIT-I: Cell Biology
Prokaryotic and Eukaryotic cell (plant cell)
Cell organells - Chloroplast, Mitochondrion and Nucleus.
Cell division – Mitosis.

UNIT-II: Anatomy
Tissues - Meristematic and permanent tissues. Primary and Normal Secondary thickening of Dicot stem.

UNIT-III: Bacteria and Viruses
Bacteria - General characters - shape - flagellation - Structure of E. Coil - reproduction - (Vegetative
and asexual), Economic importance. Structure of Tobaco Mosaic Virus, Bacteriophage.

UNIT-IV: Structure and Life History of
a) Chlorella and Gracilaria
b) Albugo, Penicilium and Agaricus

UNIT-V: Structure and Life History of
a) Funaria
b) Lycopodium
c) Cycas
Economic importance of Chlorella, Penicillium and Agaricus.

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PAPER-1

3. ZOOLOGY I

Objective;

To acquire knowledge about different kinds of animals species.

To study the systematic and functional morphology of invertebrates and chordates.

UNIT-I

   Type study includes life history.

    Protozoa – entamoeba, Porifera- Sycon. Coelenterata – Obelia geniculata. Platyhelminthes - Teania solium.

Unit II

Annilida – earthworm , Arthropoda – Prawn, Mollusca – Freshwater Mussel,Echinodermata –Sea Star.

UNIT-III

    Type study includes morphology, digestive system, respiratory system, circulatory system and urinogenital system of Chordate. Chordate – general characters, Prochordata; morphology of Amphioxus. Vertebrates; Pisces –Shark.

UNIT-IV

    Amphibia; Frog, Reptiles; calotes.

UNIT-V

    Aves; Pigeon, Mammalia; Rabbit.

References;

1.Ayyar, E.K. and T.N. Ananthakrishnan. 1992. Manual of Zoology. Volume I & I, S. Viswanathan (printers and publishers) Pvt. Ltd., Madras, 891 p.

2. Kotpal series, 1998 – 1992. Rastogi publications, Meerut.

3. Jordan E.L. and P.S. Verma. 1993. Invertebrate Zoology 12th edition, S. Chand & Co., Ltd., New Delhi.

4. Jordan, E.L. and P.S. Verma. 1995. Chordate Zoology and Elements of Animal physiology , S. Chand & Co., Ltd., New Delhi.

Outcomes;

1. The students will be able to understand the life – cycle to and adaptations of protozoa, porifera coelenterata and platy helminthes.
2. The student will be able to understand the functional morphology of Annelids, Arthropods , Molluscs and Echinoderms.
3. The student will be able acquire knowledge about the functional morphology of chordata, prochordatas and pisces.
4. The student will be able have a thorough knowledge about Frog and Calotes.
5. The student will be able to understand the functional morphology of Aves and Mammals.

4. BIOCHEMISTRY I

OBJECTIVE:

To acquire knowledge on the structure and functions of biomolecules

At the end of the course, the students will be able to

CO1	Explain the structure, biological importance of carbohydrates, from monosaccharides to polysaccharides
CO2	Identify the structure and classification of amino acids,
CO3	Classify proteins and explain their properties
CO4	Define and classify lipids with examples, explain the properties of fats and describe the structure and biological functions of phospholipids, glycolipids and sterols
CO5	Illustrate the structure of nucleotides, distinguish DNA and RNA and describe the structure of DNA, types of RNA and their biological functions

UNIT-I: Carbohydrates

Definition and Classification of carbohydrate. Monosaccharides–Glucose, Fructose and Arabinose, Linear and ring forms (Haworth formula)for glucose and fructose. Anomer, epimer and enatiomers-Definition with examples. Disaccharides –Definition- Sucrose, maltose and Lactose occurrence, structure and functions. Polysaccharides –Homopolysaccharides -Starch -Structure and functions. Heteropolysacharides-Aminosugars and sugar acids.

UNIT-II: Amino acids

Definition and classification of amino acids. Reaction of amino acids with ninhydrin, Color reactions of amino acids (Xanthoproteic test, Morners test, Millons test, Sakaguchi test, Lead acetate test and Pauly's test), Amphoteric nature, isoelectric pH and Zwitter ion.

UNIT-III: Proteins

Proteins-Definition. Peptide bond formation. Classification of proteins based on solubility, shape and size. Denaturation. Structure of protein: primary, secondary, tertiary and quaternary structure.

UNIT-IV: Lipids

Definition, classification and functions of lipids. Occurrence, chemistry and biologicalfunctions of simple lipids, compound lipids (e.g. phospholipids) and derived lipids:steroids (e.g. cholesterol). Physical property-emulsification. Chemical property-saponification. Functions of bile acids and bile salts.

UNIT- V: Nucleic acids

Nucleic acid- Composition of nucleic acid. Definition - nucleoside, nucleotide and polynucleotide. Double helical model of DNAand its biological functions. Chargaff's rule. RNA-Structure, types and functions of RNA: tRNA, mRNAand rRNA. Differences between DNA and RNA

REFERENCES

3. J. L. Jain, Nitin Jain, Sunjai Jai., Fundamentals of Biochemistry 7th editionS. Chand @ Co.Ltd .,2016

4. U. Satyanarayanan BiochemistryElseiver 2017

5. David.L.Nelson, Michael. M.Cox Lehninger principles of Biochemistry 7theditionFreeman. W.H. and Company2017

6. Victor Rodwell Harper's Illustrated Biochemistry McGrew. Hill 2018

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PAPER-1

MATHEMATICS – I

Objectives of the Course:
    To Explore the Fundamental Concepts of Mathematics

UNIT-I: ALGEBRA
    Partial Fractions - Binomial, Exponential and logarithmic Series (without Proof) - Summation - Simple problems

UNIT-II : THEORY OF EQUATIONS
    Polynomial Equations with real Coefficients - Irrational roots - Complex roots- Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations - Newton's method to find a root approximately - Simple problems.

UNIT-III : MATRICES
    Symmetric - Skew-Symmetric - Orthogonal and Unitary matrices - Eigen roots and eigen vectors – Cayley - Hamilton theorem (without proof)-Verification and computation of inverse matrix

UNIT-IV: TRIGONOMETRY
    Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ - Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ.

UNIT-V: DIFFERENTIAL CALCULUS
    Successive differentiation upto third order, Jacobians -Concepts of polar co-ordinates-Curvature and radius of curvature in Cartesian co-ordinates and in polar co-ordinates.

Recommended Text:
P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics,* Vol. I & II.Muhil Publishers, Chennai.

Reference Books:
1. P.Balasubramanian and K.G.Subramanian,(1997) *Ancillary Mathematics.* Vol. I & II. Tata McGraw Hill, New Delhi.

2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II. VikasPublications, New Delhi.

3. P.R.Vittal (2003) *Allied Mathematics* .Marghan Publications, Chennai

4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.

5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai.

SEMESTER II

PAPER – 2

GENERAL CHEMISTRY - II

OBJECTIVES:
- Basic knowledge on s- and p- Block Elements, Group Study, Hydrocarbons, Cycloalkanes, Dienes, Quantum Chemistry, Thermochemistry, First Law of Thermodynamics, Derivation of Equations, Related Problems, Reaction Mechanism and Applications wherever necessary are to be taught for II- Semester.

Course Outcomes:

Upon completion of this course, the students will be able to

1) Compare the basic properties of elements and their Compounds of s & p – block elements.

2) Explain the reaction mechanisms of alkanes, alkenes and alkynes and predict the products.

3) Classify dienes and analyze the stability of alkanes, alkenes and cycloalkanes.

4) Recollect the basic concepts of Quantum Theory and Thermodynamics.

5) Calculate the thermodynamic parameters using thermo chemical equations and data.

UNIT-I s- and p- Block Elements
1.1 Alkali metals - Li, Na, K, Rb and Cs - Occurrence - Comparative study of Elements with respect to Oxides, Halides, Hydroxides and Carbonates - Exceptional property of Lithium - Diagonal Relationship of Li with Mg.
1.2 Alkaline earth metals - Be, Mg, Ca, Sr and Ba - Occurrence - Comparative study of the elements with respect to Oxides, Hydroxides, Halides, Sulphates and Carbonates - Exceptional property of Beryllium - Diagonal relationship of Be with Al - Comparison of Alkaline Earth Metals with Alkali Metals - Magnesium acting as bridge element between II A and II B groups - Magnesium resembles Zinc.
1.3 p- Block elements - Boron family - Group discussion - Anomalous behaviour of Boron - Diagonal Relationship between Boron and Silicon - Electron deficiency and Electron acceptor behaviour of Boron trihalides - Bonding in Diborane (Hydrogen-bridge structure) - Preparation, Properties, structure and Uses of Borazine,$NaBH_4$, $LiAlH_4$ and boron nitride.

UNIT-II HYDROCARBONS
2.1 Alkanes - Methods of preparation of alkanes - Wurtz method, Kolbe's method and Reduction of alkyl halides - Physical and Chemical Properties of alkanes - Mechanism of Free Radical Substitution in alkanes – Halogenation and Reactivity.
2.2 Alkenes - Properties of alkenes – Electrophilic and Free radical addition - Addition reactions of Alkenes with mechanism - Addition of Hydrogen, Halogens,

Hydrogen Halide (Markownikoff''s rule) - Hydrogen bromide (Peroxide effect) - Sulphuric Acid, Water, BH_3, Ozonolysis, Hydroxylation with $KMnO_4$ - Allylic substitution by NBS.

2.3 Alkynes - Acidity of alkynes - Addition of hydrogen - Hydroboration - Hydrohalogenation - Addition of hypohalous acid, Hydration - Addition of water with $HgSO_4$ catalyst - Oxidation with $KMnO_4$ – Ozonolysis - Formation of Acetylides.

UNIT-III DIENES AND CYCLOALKANES

3.1 Dienes – Classification - Conjugated, Isolated and Cumulative Dienes - Stability of
Dienes - 1, 2- and 1, 4- Addition reactions of H_2 and HX with mechanisms – Synthesis of dienes – 1, 3 - Butadiene, Isoprene and Chloroprene - Diels-Alder reaction.

3.2 Cycloalkanes - Preparation using Wurtz's reaction, Dieckmann's ring closure and Reduction of aromatic hydrocarbons - Substitution and Ring opening reactions.

3.3 Stability of Alkanes, Alkenes and Cycloalkanes - Bayer's strain theory - Theory of Strainless rings.

UNIT-IV QUANTUM CHEMISTRY AND THERMOCHEMISTRY

4.1 Planck's Quantum theory of radiation - Photoelectric Effect - Compton Effect - Wave mechanical concept of the atom - de Broglie's relationship – Davisson and Germer experiment - Wave nature of electron - Heisenberg's Uncertainty Principle.

4.2 Schrodinger wave equation (Without derivation) - Significance of wave functions ψ and ψ^2 - Shapes of s, p and d- orbitals.

4.3 Thermodynamics - Definition and Explanation of terms - System, Boundary, Surroundings - Homogeneous and Heterogeneous systems – Open, Closed and Isolated systems -Intensive and Extensive properties - State of a system - Independent state variables - Dependent state variables - Thermodynamic functions - State and Path functions.

UNIT-V THERMODYNAMICS

5.1 Thermodynamic processes - Types of processes - Cyclic - Reversible – Irreversible - Isothermal – Adiabatic Process - Exact and Inexact Differentials - Concept of Heat and Work - Zeroth Law of Thermodynamics.

5.2 First law of Thermodynamics - Statement and Equation – C_p and C_v Relationship - Calculation of w, q, ΔE and ΔH for the Expansion of Ideal Gases under Reversible, Isothermal and Adiabatic Conditions.

5.3 Thermochemistry - Heat of a reaction - Exothermic and Endothermic reactions - Calculation of ΔH from ΔE and vice versa - Thermochemical equations - Bond dissociation energy - Calculation from thermochemical data - Variation of Heat of a reaction with temperature - Kirchoff's Equation and Its significance.

CORE PRACTICAL

Paper – 1

VOLUMETRIC ANALYSIS

Acidimetry

1. Estimation of Borax - Standard Sodium Carbonate

2. Estimation of Sodium Hydroxide - Standard Sodium Carbonate

3. Estimation of HCl – Standard Oxalic Acid.

Iodometry

4. Estimation of Copper - Standard Copper Sulphate

5. Estimation of Potassium Dichromate - Standard Potassium Dichromate

Complexometry

6. Estimation of Magnesium using EDTA.

7. Estimation of Zinc using EDTA

Dichrometry

8. Estimation of Ferrous Iron using Diphenyl amine / N- pPhenylanthranillic acid as indicator.

Precipitation titration

9. Estimation of Chloride in neutral medium (Demonstration experiment).

Permanganometry

10. Estimation of Ferrous Sulphate – Standard FAS.

11. Estimation of Oxalic Acid – Standard Oxalic Acid.

- Students must write Short Procedure for the given estimation in Ten Minutes during the examination and submit the Paper for Evaluation.

ALLIED 1
PAPER-2

1. PHYSICS II

Course Objectives

1. To study the concept of special theory of relativity.
2. To expose the structure of atom with different models.
3. To know the definition of binding energy and to study about nuclear models
4. To learn the different number system in digital electronics and logic gates
5. To give an introduction about nanomaterial.

UNIT-1: Special Theory of Relativity

Frames of reference-inertial frames and non-inertial frames -Galilean transformations - Michelson-Morley experiment-interpretation of results - postulates of special theory of relativity Lorentz transformation equations -length contraction - time dilation - transformation of velocities -variation of mass with velocity -Mass-energy equation.

UNIT-2: Atomic Physics

Bohr atom model – Critical Potentials - Experimental determination of critical potentials - Franck and Hertz's experiment -Sommerfield's Relativistic atom model The vector atom model – spatial quantization–spinning of an electron –quantum numbers associated with the vector atom model – coupling schemes –LS and jj coupling – the Pauli's exclusion principle – Stern and Gerlach experiment

UNIT-3: Nuclear Physics

Binding energy-Binding energy per nucleon-Packing fraction-Nuclear models – liquid drop model – semi empirical mass formula – merits and demerits -shell model -evidences for shell model – nuclear radiation detectors –ionization chamber – G.M Counter-Wilson cloud chamber-Particle accelerators-Cyclotron-Betatron.

Unit-4: Digital Electronics

Number systems -Decimal, Binary, Octal and Hexadecimal system – Conversion from one number system to another- Binary Arithmetic -Addition –Subtraction- 1's and 2's complement -Binary codes- BCD code – Excess 3 code, Gray code.

NAND, NOR and EXOR – functions and truth tables. NAND & NOR as universal gates-Half adder and Full adder - Half subtractor and Full subtractor using NAND gate only.

UNIT-5: Nanomaterial

Introduction-Nanomaterial- Properties of nanomaterial (size dependent) -synthesis of

nanomaterial- sol gel- hydrothermal method-Scanning Electron Microscope (SEM)- Principle and Instrumentation-Fullerenes- Carbon nanotubes- Fabrication and structure of carbon nanotubes - Properties of carbon nanotubes (Mechanical and Electrical) - Applications ofCNT's.

Text Books

Unit 1 to Unit 3

1. Modern Physics – R,Murugeshan, KiruthigaSivaprasath, S.Chand&Co, New

   Delhi, 2016

Unit 4

1. V.Vijayendran, Introduction to Integrated Electronics (Digital & Analog), S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007

Unit 5

1. V. Raghavan, *Material Science and Engineering* ,Printice Hall India.,2004.

Reference Book

1. Allied Physics – R. Murugesan S. Chand & Co. New Delhi, 2005.
2. A Text book of Digital electronics – R.S.Sedha, S.Chand&Co, 2013
3. Malvino and Leech, Digital Principles and Application, 4th Edition, Tata McGraw

   Hill, New Delhi, 2000.

4. Dr. M.N. Avadhanulu, *Material science*, S.Chand& Company, New Delhi, 2014.
5. M.Arumugam, *Material science*, Anuradhapuplishers, 1990.
6. V. Rajendran, *Material Science*, Tata McGraw Hill Ltd, New Delhi,2001.
7. D.C.Tayal, Nuclear Physics, Himalaya Publishing House, 2009

E-MATERIALS

1. https://en.wikipedia.org/wiki/Galilean_transformation
2. https://www.youtube.com/watch?v=NH3_lIkSB9s
3. https://www.youtube.com/watch?v=EEWuUst2GK4
4. https://en.wikipedia.org/wiki/Vector_model_of_the_atom
5. https://www.tutorialspoint.com/what-is-a-geiger-muller-counter
6. https://www.youtube.com/watch?v=jxY6RC52Cf0
7. https://www.tutorialspoint.com/digital_circuits/digital_circuits_number_systems.htm
8. https://www.youtube.com/watch?v=4ae9sJBBkvw
9. https://en.wikipedia.org/wiki/Nanomaterials
10. https://www.youtube.com/watch?v=mPxoJz6treE (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to study the frames of reference, Galilean transformation equations and special theory of relativity.

2. After studied unit-2, the student will be able to describe the different atomic models and Stern and Gerlach Experiment.
3. After studied unit-3, the student will be able to explain binding energy, liquid drop model, G.M counter and particle accelerators.
4. After studied unit-4, the student will be able to know the conversion of number systems from one to other and also will be able to design universal gates using NAND and NOR gates.
5. After studied unit-5, the student will be able to understanding the basics of nanomaterial, synthesis and its applications.

ALLIED PRACTICAL- PHYSICS

List of Experiments (Any 12 Experiments only)

1. Determination of 'g' using Compound pendulum.
2. Young's modulus-Non-Uniform bending-Pin & microscope
3. Rigidity Modulus – Torsional oscillation method (without masses).
4. Rigidity Modulus – Static Torsion method using Scale and Telescope.
5. Surface tension and Interfacial Surface tension by Drop Weight method.
6. Sonometer – Frequency of a Tuning fork.
7. Sonometer –Determination of A.C. frequency- using steel and brass wire
8. Air Wedge – Determination of thickness of a thin wire
9. Newton's Rings – Radius of Curvature of a convex lens.
10. Spectrometer – Refractive index of a liquid – Hollow prism.
11. Spectrometer grating – Minimum Deviation- Wavelength of Mercury lines.
12. Potentiometer – Calibration of Low range voltmeter.
13. Deflection magnetometer and Vibration magnetometer-Tan C Position-Determination of

    m and B_H.
14. Figure of merit- Table galvanometer.
15. Construction of AND, OR gates using diodes and NOT gate using a transistor.
16. NAND/NOR as universal gate.
17. Half adder and Full adder using NAND gate.
18. Half subtractor and Full subtractor using NAND gate.
19. Lasers: Study of laser beam parameters.
20. Measurement of Numerical aperture (NA) of a telecommunication graded index optic fiber.
21. Fiber attenuation of a given optical fiber.

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.

2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Dr. S. Somasundaram, Practical Physics, Apsarapublications,Tiruchirapalli, 2012.
2. R. Sasikumar, Practical Physics, PHI Learning Pvt. Ltd, New Delhi, 2011.

ALLIED 1
PAPER-2

2. BOTANY II

UNIT-I: Taxonomy

General outline of Bentham and Hooker's system of classification. Study of the range of characters and economic importance of the following families: Annonaceae, cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

UNIT-II: Embryology

Structure of mature anther. Structure of mature ovule and its types. Fertilization.

UNIT-III: Plant Physiology & Plant Tissue Culture

Physiological role of micro and macro elements their deficiency symptoms Photosynthesis - lightreaction - Calvin cycle Respiration - Glycolysis - Kreb's cycle - electron transport system. Growth hormones – Auxins. Tissue culture and its principles.

UNIT-IV: Ecology

Ecosystem - fresh water ecosystem. Environmental pollution. Major pollutants - types of pollution - Air pollution, water pollution, soil pollution - control measures.

UNIT-V: Genetics & Evolution

Mendelism - Monohybrid and dihybrid crosses. Theories of evolution - Lamarckism, Darwinism.

ALLIED PRACTICAL
BOTANY – I & II

Description of plants in technical terms belonging to the families mentioned in the theory part.
To study the internal structure of Anatomy material, Pteridophytes and Gymnosperms.
Identification and Description of Micro Preparation materials mentioned in the theory part.
Description of experimental setup of plant physiology.

BOOKS SUGGESTED

Ashok Bendre, A.K. and Pandey P.C. (1975) Introductory Botany. Rastogi Publication Meerut.

Ganguly, A.K. and Kumar. N.C. (1971) General Botany Vol. I & Vol. II, Emkay Publication, Delhi.

Rev. Fr. Ignacimuthu, S.J. (1975) Basic Biotechnology – Tata Mcraw till publication co., New Delhi.

Rao, K.N. Krishnamoorthy, K.V. and Rao. G. (1975) Ancillary Botany. S. Viswanathan Private. Ltd., Chennai.

ALLIED 1
PAPER-2
3. ZOOLOGY II

Objective;

 -To study the principles of Cell biology and Genetics.

 - To study the principles of Developmental Biology and Physiology.

 - To have a complete knowledge about circulatory systems and excretory system.

 - To create awareness towards recent changes in the environment and preventive measures.

 - To understand the concepts of origin of life.

UNIT-I

     Cell Biology – structure of animal cell, Genetic; molecular structure of gene – gene function, sex linked inheritance. Genetic engineering and its application.

UNIT-II

     Embryology – cleavage and gastrulation of Amphioxus.

     Human Physiology; Digestion, circulation – blood components, structure of heart, heart function.

UNIT-III

     Disease of Circulatory system – blood pressure, heart disease – Ischemia, Myocardial infarction, Rheumatic heart disease, stroke.

      Excretion – structure of kidney and mechanisms of urine formation.

UNIT-IV

     Environmental Biology – Biotic factors and Abiotic factors, food chain and food web. Pollution – Environmental Degradation, (Air, Water and Land) – Green house effect – Bioremediation, - Global warming – acid rain.

UNIT-V

     Evolution; Theories of Lamarkism & Darwinism.

Reference;

1. Ekambaranatha Ayyar, and Ananthakrishnan, T.N. 1993.   Outlines of Zoology, Vol I & II, Viswanathan and Co, Madras.
2. Sambasiviah, I, Kamalakara Rao, A.P., Augustine Chellappa, S. 1983. Text book of Animal Physiology, S. Chand & Co., New Delhi.

3. Verma and Agarwal. 1983. Text book of animal Ecology, S. Chand & Co., New Delhi.
4. Verma and Agarwal and Tyagi. 1991. Chordate Embryology, S. Chand & Co., New Delhi.
5. Rastogi and Jayaraj. 2000. Taxt book of genetics. Rastogi publications, Meerut.
6. Verma and Agarawal. 2000. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Co., New Delhi.

Outcomes;

1. The student will acquire knowledge about cell structure, gene function and Genetic engineering.
2. The student will be able to understand the cleavage pattern and gastrulation in Amphioxus.
3. The students will have a thorough knowledge about the diseases of circulatory systems and urine formation.
4. The student will be have an awareness about the environment.
5. The student will understand the basic concepts of evolution.

ALLIED PRACTICAL

ZOOLOGY

I MAJOR PRACTICAL

DISSECTIONS

Cockroach; Digestive and nervous system

Prawn; nervous system

II MINOR PRACTICAL

MOUNTING

1. Mouth parts of Mosquito and Honey bee
2. Earthworm – Body setae
3. Placoid scales of Shark

III SPOTTERS

Entamoeba, Sycan, Obelia, Taenia solium (entire, scolex) earthworm (entire, Pineal setae) Prawn (entire), Fresh water mussel, Sea star, Amphioxus – Entire, Amphioxus – T.S. through pharynx, Shark, Frog, Calotes, Pigeon, feathers of pigeon and Rabbit.

Sphygnomanometer, Stethoscope, Rain gauge.

References;

1.verma. P.S. 2011. A manual of practical Zoology – INVERTEBRATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

2. Verma. P.S. 2011. A manual of practical Zoology – CHORDATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

4. BIOCHEMISTRY II

OBJECTIVE:

To acquire a wide knowledge on metabolism, disorders of metabolism and biological functions of vitamins and minerals

At the end of the course, the students will be able to

CO1 Illustrate the reactions of various metabolic pathways

CO2 Acquire knowledge on the various metabolic disorders

CO3 Classify enzymes and explain their functions

CO4 Define and classify vitamins with examples, explain the sources, RDA and functions of fat soluble and water soluble vitamins

CO5 Illustrate the sources, RDA and functions of minerals

UNIT-I: Metabolism

Metabolism-Catabolism and anabolism-Definition. Reactions of glucose oxidation-Glycolysis, TCA cycle and its energetics, HMP shunt and its significance. Amino acid-transamination and Deamination,reaction, Urea cycle- Formation of urea.

UNIT-II: Metabolic Disorders

Diabetes mellitus- definition. Types and symptoms. Glycogen storage diseases-Types, Renal Glycosuria-Definition and causes. In born errors of amino acid metabolism- Phenylketonuria, Alkaptonuria (Black urine syndrome) and albinism

UNIT-III: Enzymes

Enzymes-Definition, IUB system of classification with one example. Mechanism of enzyme action- Lock and key mechanism, Induced Fit theory. Michaleis-Menton equation. Coenzymes- Vitamins as coenzymes (Tabulation of Coenzymes with functions in metabolism)

UNIT-IV: Vitamins

Vitamins- fat soluble (Vitamin A, D, E and K) and water soluble vitamins (Vitamin B1, B2, B3 and B12),Vitamin C - sources, RDA, biological function and deficiency of Vitamins of the above mentioned vitamins

UNIT V-Minerals

Minerals- sources, RDA, biological functions and deficiency of Calcium, Iron, Phosporus, Sodium and potassium. Examples of minerals as cofactors in metabolism.

REFERENCES

1. J. L. Jain, Nitin Jain, Sunjai Jai., Fundamentals of Biochemistry 7th edition S. Chand @ Co.Ltd .,2016

2. U. Satyanarayanan BiochemistryElseiver 2017

3. David.L.Nelson, Michael. M.CoxLehninger principles of Biochemistry 7th editionFreeman. W.H. and Company2017

4. Victor RodwellHarper's Illustrated BiochemistryMcGrew. Hill 2018

PRACTICAL I

BIOCHEMISTRY I & II

CO NUMBER	CO Statement
CO1	Quantify glucose in unknown solution by benedicts method
CO2	Quantify ascorbic acid in lemon by Dichlorophenol indo phenol dye method
CO3	Quantify glycine by Sorenson's formal titration method
CO4	Qualitatively analyze the carbohydrates and amino acids and report the type of carbohydrate based on specific tests
CO5	Differentiate the carbohydrates based microscopic examination of the crystal structure.

Volumetric Estimation

1. Estimation of Glucose by Benedict's method.
2. Estimation of Ascorbic acid by 2, 6 dichlorophenol indophenols dye method.
3. Estimation of Glycine by Sorenson's formal titration.

A) Qualitative analysis of Carbohydrates

1. Qualitative analysis of Glucose,
2. Qualitative analysis of Fructose,
3. Qualitative analysis of Sucrose
4. Qualitative analysis of Maltose,
5. Qualitative analysis of Starch

B) Qualitative analysis of Amino acids

1. Qualitative analysis of Arginine,
2. Qualitative analysis of Cysteine,
3. Qualitative analysis of Tryptophan
4. Qualitative analysis of Tyrosine
5. Qualitative analysis of Histidine

REFERENCES

1. J. Jayaraman,Laboratory Manual in Biochemistry New Age International Pvt Ltd Publishers
2011
2. S. K. SawhneyRandhir Singh Introductory Practical Biochemistry Alpha Science International, Ltd,2 edition, 2005.
3. Irwin H.Saegal Biochemical calculations Liss, Newyork 1991

5. MATHEMATICS - II

Objectives of the Course

To Explore the Fundamental Concepts of Mathematics

UNIT-I: Application of Integration

Evaluation of double, triple integrals - Simple applications to area, volume - Fourier series for functions in $(0, 2\pi)$ and $(-\pi, \pi)$.

UNIT-II: Partial Differential Equations

Formation, complete integrals and general integrals - Four standard types, Lagrange's equations.

UNIT-III: Laplace Transforms

Laplace Transformations of standard functions and simple properties - Inverse Laplace transforms - Applications to solutions of linear differential equations of order 1 and 2-simple problems

UNIT-IV: Vector Analysis

Scalar point functions - Vector point functions - Gradient, divergence, curl - Directional derivatives - Unit to normal to a surface.

UNIT-V: Vector Analysis (continued)

Line and surface integrals - Guass, Stoke's and Green's theorems (without proofs) - Simple problem based on these Theorems.

Recommended Text

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II.Muhil Publishers, Chennai

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997)*Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.

2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II.Vikas Publications, New Delhi.

3. P.R.Vittal(2003). *Allied Mathematics* .Marghan Publications, Chennai.

4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.

5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai

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