

SCIENTIFIC ASSISTANT BIOLOGY GROUP
SYLLABUS

Concept of Sterilization

Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration. Physical and Chemical methods of sterilization; disinfection sanitization, antiseptics sterilants and fumigation. Determination of phenol coefficient of disinfectant.

Commercial Production of Microorganisms :

Industrial Fermenters, Single-cell Protein.

Enzyme technology:

Nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.

Immunology:

1. Immune Response - an overview, components of mammalian immune system, molecular structure of Immunoglobulins or Antibodies, Humoral & Cellular immune responses, T-lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity maturation class switching, assembly of T-cell receptor genes by somatic recombination.

2. Immuno-techniques - Blood grouping, Antigen-Antibody reactions : agglutination, precipitation, immuno-electrophoresis, Coomb's test, ELISA, RIA.

Microbial Interactions with Human

1. Beneficial Microbial Interactions with Human

2. Harmful Microbial Interactions with Human

Virulence factors: exotoxins, enterotoxins, endotoxins, neurotoxins. avoidance of host defence mechanisms, damage to host cell, Host factors for infection and innate resistance to infection. Person to person Microbial disease Airborne transmission of diseases by micro organisms

Direct contact transmission of diseases : Staphylococcus, Helicobacter pylori and Gastric ulcers, Hepatitis viruses Animal transmitted, Arthropod transmitted ,Soil borne and Water borne microbial diseases

Microbial Genetics

1. **Prokaryotic Genomes:** Structure of the bacterial nucleoid, Replication and partitioning of the bacterial genome.

2. **Mechanism of genetic exchange :**

3. **Molecular Mechanism of gene regulation in prokaryotes:**

4. **Bacteriophages:**

Molecular Genetics

1. **Purification and Separation of nucleic acids** – Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis.

2. Cutting and Joining DNA – Restriction Endonucleases, Ligation, Alkaline Phosphate, Double Digest, Modification of Restriction Fragments ends, Other Ways of joining DNA Molecules.

3. Vectors – Plasmid vectors, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors, Vectors for cloning and expression in Eukaryotic cells, Super vectors : YACs and BACs.

4. Amplifying DNA : PCR and Cell based DNA Cloning – The importance of DNA Cloning, PCR : basic features and application, Principles of Cell-based DNA Cloning, Cloning System for amplifying different sized fragments, Cloning System for producing single-stranded and mutagenized DNA.

5. Nucleic Acid Hybridization : Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, Nucleic acid hybridization assays, and microarrays.

DNA Typing, Proteomics

1. DNA Typing : DNA polymorphisms: the basis of DNA typing, Minisatellite analysis, Polymerase chain reaction based analysis, Short tandem repeat analysis, Mitochondrial DNA analysis, Y chromosome analysis, Randomly amplified polymorphic DNA (RAPD) analysis.

2. Proteomics and beyond : Analysis of the transcriptome, Proteomics-Expression analysis & Characterization of proteins, Metabolomics & global biochemical networks.

3. High-throughput analysis of gene function - DNA microarrays, Protein arrays, Mass spectrometry.

4. Single Nucleotide Polymorphisms - The nucleolar proteome, Mapping disease-associated SNPs : Alzheimer's disease.

Recombinant DNA Technology:

Gene Recombination and Gene transfer : Bacterial Conjugation, Transformation, Transduction, Episomes, Plasmids, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser.

Human Genome Project:

1. Genome projects – an overview of genome projects of human and other model organisms of Human Genome Project.

2. Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, expected scientific & medical benefits of this project, about the organizations behind this project.

3 Technologies used in HGP – RFLP, microsatellite markers, STS, EST, DNA sequencing, DNA microarray.

Biodiversity & Taxonomy

1. Basic concept of Biodiversity – What is Biodiversity, Why should we conserve it, Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity, Patterns of Species Diversity

2. Global patterns of Biodiversity – measuring biodiversity, Cataloging and Discovering Species, Geographical Patterns of Species Richness, Biogeography,

Importance of Distribution Patterns(Local Endemics, Sparsely Distributed Species, Migratory Species), GAP Analysis.

3. Biodiversity & Conservation – Overexploitation threatening living species,International Trade, Animals threatened by International trade, Problems inControlling International Trade (Enforcement, Reservations, Illegal Trade), FreeTrade & the Environment, Free Trade & Conservation, Common patterns of Overexploitation.

4. Ethics of Conservation – Values of Biodiversity, Global Conservation Issues.

Taxonomy:

1.Basic concept of Taxonomy – Classification, Construction of Phylogenetic tree, Systematics, Cladistics, Cladograms, Phenetics, Nomenclature.

2.Taxonomy in relation to Chromosomal morphology & Evolution – Chromosomal evolution, why location of genes matter, evolutionary oddities about chromosomes, evolutionary effect of rearrangements of chromosomes.

LABORATORY TECHNICIAN BIOLOGY GROUP

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Evolution:

Introduction, different concepts of Origin of life, Theories of organic evolution, Theory of inheritance of acquired characters (Lamarckism). Theory of natural selection, Mutation theory and synthetic theory, Speciation and isolating mechanism, Morphological criteria for species and races. Allopathic and sympatric population. Isolating mechanism.

Plant Kingdom

General characters of plant, Body organization: Root, Stem and Leaves; Tissues: Dermal, Vascular and Ground

Structure of cell

Chemistry and Ultra structure of Cell wall, Cell membrane, Flagella and Cilia
Organelles Mitochondria, Chloroplast, Golgi bodies, Peroxysome, Endoplasmic Reticulum , Ribosome.

Fundamentals of Biology

1.General Characteristics, classification and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes & Gymnosperms.

2.Angiosperms: Principle of classification and nomenclature of angiosperms, Anatomy of angiosperms, Structure and development of anthers and ovules, fertilization, seed development, seed dormancy and germination.

3.Non-Chordates: General characteristics, classification and economic importance of Protozoa, Porifera, Coelentrate, Helminthes, Annelida, Arthropoda, Mollusca and Echinodermata.

4.Chordates: General characteristics, Classification and importance of Protochordata, Hemichordate, Urochordata, Cephalochordata and Cyclostomata, Amphibia, Reptilia, Aves and Mammalia.

Biochemistry

1. Carbohydrates : Structural aspects – Introduction & Occurrence, Classification of Mono-, Di- and Polysaccharides, Reducing & Non-reducing Sugars, Constitution of Glucose & Fructose, Osazone formation, Pyranose & Furanose forms, Determination of ring size, Inter-conversion of monosaccharides.

2. Lipids : Structural aspects – General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, Membrane protein – structural aspects, Lipoproteins .

3. Proteins : Structural aspects – General introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins.

4. Nucleic acid : Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides(introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.

5. Chemical & Enzymatic Kinetics - An introduction to enzyme; How enzyme works; Reaction rate; Thermodynamic definitions; Principles of catalytic power and specificity of enzymes; Enzyme kinetics – Approach to mechanism.

6. Mutation – Occurrence, kinds of Mutation, spontaneous & induced Mutation, Mutagens, detection of Mutation, Lethal Mutations, Biochemical Mutations, Phenotypic effects of Mutation, Molecular basis of Mutation, Significance & Practical applications of Mutation.

7. Expression of genetic information : from Transcription to Translation – The Relationship between genes and protein, The transcriptions : The basic process, Transcription and RNA Processing in Eukaryotic Cells, Encoding genetic information, Decoding the codons : the role of transfer RNAs.

8. Regulation of mRNA stability – capping, polyadenylation, pre-mRNA splicing, information of commitment complex, creation of catalytic sites, transesterification reactions, mRNA surveillance.

Organic Mechanisms in Biology

Common Mechanisms in Biological Chemistry – Overview of Digestion, Absorption, Metabolism (Anabolism & Catabolism), Nutrition, Photosynthesis, Respiration, Excretion.

Biomolecules

Carbohydrates (Anomeric carbon, Simple Chemical reactions of Glucose, Reducing & Non-reducing Sucrose, Maltose & Lactose, Elementary idea of structure of Starch & Cellulose); Proteins (Denaturation of proteins, Enzyme Kinetics), Nucleic acids (Mechanisms of Replication, Transcription & Protein synthesis, Genetic code); Hormones (classification, structural features & functions in bio-systems); Vitamins (classification, functions of vitamins in bio-systems).

Carbohydrate Metabolism – Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle, glycogenesis, glycogenolysis (sequence of reactions & regulation), Pentose-phosphate pathway (sequence of reactions & regulation), extraction of energy from food sources.

Cellular Metabolism

Oxidation-Reduction, Energy and Carbons source utilization, Electron transport chain and ATP generation

Metabolism: Anabolism, Catabolism, Respiration, Fermentation, Photosynthesis
Nutrient uptake: Active transport, Passive transport, Facilitated diffusion, Group translocation

Enzymes: Properties, Mechanism of catalysis, Allosteric controls

Cell Division

Cell division, Phases, Mitosis and Meiosis Growth and Tumour

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Physiology of Plants

Cell as a functional unit, Composition of protoplasm; water relations; Absorption and conduction (Diffusion, osmosis, plasmolysis, permeability, water potential, absorption)

Mineral absorption - functions of mineral elements; essential major elements and trace elements; deficiency symptoms of elements.

Photosynthesis - significance; site of photosynthesis (functional importance of chlorophyll structure) photochemical and bio synthetic phases. Electron transport system.

Physiology of Animals

Nutrition and its types; nutrients food and vitamins; digestive system of invertebrate (Cockroach)

Digestive system and digestion process in humans (ingestion, digestion, absorption, assimilation, formation of faecal matter, defecation) (Intra cellular and extra cellular); role of enzymes and hormones indigestion.

Respiration in humans; respiratory organs; mechanism of respiration. Glycolysis, fermentation (Alcoholic fermentation, Lactic acid fermentation), aerobic respiration, TCA cycle.

Human endocrine system - Hormones and their functions; hormonal regulation and diseases; hormones as neurotransmitters and regulators; Hypothelamo – hypophysial axis, feedback controls.

Blood Physiology:

1.Composition of Human blood

i Blood Plasma - Dissolved solids: Blood proteins (albumin, fibrinogen and globulins) and their roles.

ii Blood cells :a) RBC - Structure, Total count, Functions, Composition
b) WBC - Structure, Total count, Functions, Classification
c) Platelets - Structure, Total count, Functions.

2. Blood coagulation

Brief introduction and significance Factors involved in blood coagulation.

3. Groups and Blood Types:

ABO Blood Group

Transfusions

Rh Blood Group

Reproduction, Growth and Development

Modes of reproduction in flowering plants; vegetative propagation (natural and artificial); significance of vegetative propagation; sexual reproduction; development of male and female gametophyte, Pollination (types and factors); Double fertilization, incompatibility, embryo development, parthenogenesis and parthenocarpy.

Ecology and Environment

Organism and their environment; factors - Air, Water, Soil, temperature, light, biota; range of tolerance; ecological adaptations

Levels of organisation - Structure and functions, productivity, energy flow, ecological efficiencies; decomposition and nutrient cycling; major biomes - forests, grass lands and deserts.

ecological succession - types and mechanism; Natural resources types and resources. Environment pollution - kinds, sources and abatement of air, water soil and noise pollution.

Structure of Eco system: Food Chain & Food Web, Ecological Pyramids.

Energy flow

Biogeochemical cycles:

Carbon cycle, Phosphorous cycle.

Biodiversity:

Genetic diversity, species diversity

Biology and Human Welfare

Population, environment and development; Population growth and factors (Vitality, mortality, immigration, emigration, age and sex ratio)

Environment/habitat:

Major abiotic factors affecting ecology: light, temperature, water, soil.

Basic concepts of Ecology

Population interaction:

Mutualism, competition, predation, parasitism, commensalism, Amensalism, antagonism

The Living World

Origin and evolution of life

History of Earth, Theories of origin of life, Living matter.

Chemical evolution, Origin of living systems (molecules to first cell).

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Analytical Chemistry:

Introduction, The nature of analytical chemistry, The role of analytical chemistry, Classification of analytical methods (classical and instrumental) Quantitative analytical methods. An internal role for chemical analysis.

Synthetic Drugs :

General Classification, Chemotherapy, Antipyretics, Analgesics, Hypnotics, Sedatives, Anaesthetics, Antimalerials, Antiseptics, Cardiovascular drugs. Methods of preparation and uses of Antipyrine, Phenacetin, n-Hexyl resorcinol, Alprazolam, Zaleplon, Benzocaine, Lidocaine, Chloroquine, Atenolol, Sulphadiazine, Trimethoprim and Tolbutamide.

Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of cholesterol, Bile acids. Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of steroids.

Alcohol & Alcoholism:

Introduction, fermentation processes, conditions for fermentation- ethyl alcohol from molasses, characteristics of enzymes, alcoholic beverages, manufacture of beer ,manufacture of spirits, manufacture of wines, manufacture of power alcohol, importance of power alcohol as a fuel, Chemistry and Bio chemistry of Ethyl and Methyl Alcohol, Physiological effect of Alcohol and Alcohol poisoning.

Errors and treatment of Analytical data:

Definition terms of mean and median. Precision standard deviation, relative standard deviation. Accuracy ,absolute error, relative error. Types of error in experimental data determination (systematic), indeterminate (or random) and gross. Sources of errors and its effects upon the analytical results. Methods for reporting analytical data, Statistical evaluation of data indeterminate error, The uses of statistics.

Quality Control Management System :

Definition of Accreditation, History and development of ISO, Importance of accreditation in Analytical Laboratories, Introduction to Quality, Quality Assurance, Quality control, Quality system, Validation Criteria of new test methods and calibration. GLP concepts.

Forensic Chemistry:

1. Analysis of chemicals and beverages: - Analysis of Jaggery, examination of chemicals in trap cases (phenolphthalein), analysis of illicit liquor including methyl ,ethyl alcohol and other volatile compounds by Gas Head Space Analysis.

2. Fire and Arson:- Chemistry of fire, definition, scientific investigation and evaluation of clue materials, analysis of arson exhibits by instrumental methods, managements of arson case.

3. Forensic Toxicology and Poisons :

A.Toxicology: - Introduction and concepts of forensic toxicological examination and its significance.

B. Poisons:- Classification, Extraction, isolation of poison (General procedure) Gaseous and volatile poison, analysis of acidic drugs, basic drugs and neutral organic poison.

C. Preparation of Aldrine, Malathion, Parathion, Methoxychlor.

4. Forensics Explosive : Definition, classification, types, nature, composition, chemistry and characteristics of explosives i.e RDX,PETN,NG-NC,TNT,TETRYL,ANFO etc. Explode mechanism, pyrotechniques, IEDs. Specific approach to scene of explosion. Systematic examination of explosive and explosion residue in the laboratory using chemical and instrumental techniques and interpretation of results, explosive act.

5.Crime Scene Management respect to forensic chemistry.

6. Narcotic drugs & psychotropic substances: Introduction to Controlled Substances, Classification of controlled substances, Precursor chemicals, Clandestine drug laboratories, Mandatory provisions of NDPS Act, 1985, Commonly abused drugs, Drug dependence, Drug Tolerance, Designer Drugs, Drug profiling, Systematic analysis of Drug of abuse by various chemical and instrumental methods.

Oils and Fat: Introduction, distinction between oils and fats properties, classification, edible oils , manufacture of oil by solvent extraction, animal fats and oils, processing of animal fats and oils, mineral oils, difference between animal, vegetable and mineral oils, hydrocarbon oils and essential oils.

Alkaloids : Classification, General method of determining structure, analytical and synthetic methods, structure of Coniine, Nicotine, Atropine and Papaverine.

Synthetic Dyes : Classification of Dyes- Anionic and Cationic dyes, Mordant and Vat dyes, Reactive and Dispersed dyes, Synthesis of Alizarin, Malachite green, Indigo, Congo red, Eosin.

Phase Rule : Binary system : Zn-Cd and Pb-Ag ,Zeotropic and azeotropic mixtures, Steam distillation, Zone refining.

Osmosis : Desalination and reverse osmosis, Electro dialysis, Electrochemistry and pollution control, Removal of Cu, Ag and Fe from waste water.

Solvent Extraction Separation: Principles of solvent extraction, choice of solvent, distribution coefficient, distribution ratio, percentage (%) extraction. The extraction process, solvent extraction of metals, selective extraction and separation efficiency.

Nano technology : Introduction and preparation ,Introduction to Nanomaterials, Optical, magnetic and chemical properties of Nanomaterials, Preparation of Nanoparticles: Chemical Approaches: Chemical reduction; Sonochemical synthesis; Sol-Gel Synthesis; Self assembly. Physical Approaches: Aerosol spray; Gas condensation; Laser vaporization and vapour deposition; Sputtering.

Nanostructured materials : Quantum dots, wells & wires; Carbon Nanotubes (CNTs): Single walled carbon nanotubes (SWNTs), Multiwalled carbon nanotubes

(MWNTs), Graphenes, Fullerenes, Metal/Oxide nanoparticles (NPs), Nanorods, Nanotubes and Nanofibres, Semiconductor quantum dots, Polymer NPs.

Characterization techniques for Nanomaterials -I :

Particle size Analyser (Laser scattering), Optical Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunnel Microscopy (STM).

Characterization techniques for Nanomaterials-II : X-ray Diffraction (XRD), Auger Emission Spectroscopy, Electron Spectroscopy for Chemical analysis (ESCA)

Application of Nanomaterials: Applications Solar energy conversion and catalysis, Polymers with a special architecture, Liquid crystalline systems, Applications in displays and other devices, Advanced organic materials for data storage, Photonics, Chemical and biosensors, Nanomedicine and Nanobiotechnology.

INSTRUMENTATIONS:

1. Fundamentals of Spectroscopy: Classification of spectra i.e. line, band, continuous spectra / absorption, emission spectra; Wave properties of electromagnetic radiation; Particle/photon properties of electromagnetic radiation; Electromagnetic spectrum.

2. UV-VIS Spectroscopy: Theory; Beer and Lambert's law - limitations and deviations from the law; Terminologies associated with absorption measurements; Types of transitions; Factors affecting spectral characteristics (structural and nonstructural); Effect of conjugation; Woodward Fieser rule; Photometric titrations; Instrumentation, applications (in analysis of organic compounds and inorganic complexes), advantages and limitations of UV Visible spectroscopy; Quantitative analysis of binary mixtures of absorbing substances by simultaneous equation method; Calibration of UV Visible Spectrophotometer as per standard methods.

3. Fluorescence Spectroscopy: Introduction: luminescence, photoluminescence; Theory of Fluorescence and Phosphorescence; Jablonski diagram; Factors affecting fluorescence intensity (structural and nonstructural); Instrumentation, applications, advantages and limitations of fluorescence spectroscopy

4. IR Spectroscopy: Theory of absorption of Infrared radiation by molecules; Molecular vibrations; Factors influencing vibrational frequencies; Calculation of vibrational frequencies (Hooke's law); Sample handling techniques; Instrumentation (Dispersion and FTIR spectrometer) and applications of IR Spectroscopy; Calibration of IR Spectrophotometer as per Pharmacopoeia.

5. Atomic Spectroscopy: Basics of atomic spectroscopy; Principle of atomic absorption and atomic emission spectroscopy; Interferences in atomic spectroscopy; Factors affecting atomic spectroscopy like solvents, buffers, other ions, etc; Flame Photometry; Atomic emission spectroscopy with plasma and electrical discharge sources; Instrumentation (including radiation sources like hollow cathode lamp), applications, advantages and limitations of atomic absorption and atomic emission spectroscopy.

6. Mass Spectrometry: Theory; Ionization techniques, Ion separating techniques; Different types of ions and their significance in mass spectra, Fragmentation rules and rearrangements; Instrumentation and applications of mass spectrometry. Overview of GC-MS and GC-MS-MS, interpretation of results of Isomers.

7. Nuclear Magnetic Resonance spectroscopy: Fundamental Principles - nuclear spin, magnetic moment; Proton NMR spectroscopy - theory, chemical shift and factors affecting chemical shift, spin- spin coupling, coupling constant, relaxation process, Instrumentation and applications of PMR; Brief overview of C13 NMR.

8. X-ray spectroscopy Introduction; Generation of X – rays; X-ray diffraction, Bragg's law; Applications of X- ray diffraction, EDXRF: Principle instrumentation, how does it works & Applications of EDXRF.

9. Raman spectra :Basic principle , Instrumentation , application of Raman spectra , comparison of IR and Raman spectra.

10. Gas Chromatography : Introduction; Theory and Principle of Gas-Chromatography; Mobile phase, Stationary phases for GSC and GLC; Instrumentation (including temperature programming and derivatization) and applications of GC. Principle and applications of Gas chromatography with Head space Technique .

11. High Performance Liquid Chromatography : Introduction; Theory, Classification and Principle of HPLC; Mobile phase, Stationary phases for normal and reversed phase HPLC; Instrumentation (including significance of guard column) and applications of HPLC; Comparison of HPLC with GC; Overview of LC-MS, LC-MS/MS. Basic principle, theory and applications of partition, adsorption, ion-exchange, size exclusion, Super critical fluid and Affinity chromatography.

LABORATORY TECHNICIAN CHEMISTRY GROUP

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Ionic equilibrium:- Definition of basic terms: Electrical conductance, Specific conductance, Equivalent conductance, Molar conductance, Cell constant & degree of Dissociation; Derivation of Ostwald's dilution law, its applications and Limitations; pH Scale, Hydrolysis, Relation between K_a , K_b , K_h & K_w for Strong acid- Strong base, Strong acid-Weak base, Weak acid -Strong base, Buffer Solution, (Henderson – Hasselbalch equation), Indicator theory, Useful pH range of indicator for acid base titration.

Carbohydrates : Introduction, classification of carbohydrates, osazone formation, epimerization, step up and stepdown reactions of monosaccharides, simple structures of glucose and fructose, Fischer's proof, configuration of D-glucose.

Amino acid : Introduction of amino acid, Classification and properties of amino acids, Zwitter ion, Isoelectric point

Chemical Reactivity and Molecular Structure: (Acid- Base Properties) :

Acid-Bases, scale of acidity-basicity, Resonance effect, drawing of structures and the condition for resonance, Effect of change of hybridization on acidity and basicity, Inductive and electronic effects, steric effect and hydrogen bonding, Lewis acid and bases, Keto-enol tautomerism. Difference between resonance and tautomerism.

Metals and alloys : Introduction, Physical properties of metals, cast iron, wrought iron, steel, Heat treatment of steel. Definition of alloy, purpose of making alloys. Classification of alloys. Alloys of steel and its applications. Non-Ferrous alloys and its industrial applications.

Corrosion and its inhibition : Introduction, Theories of corrosion, Types of corrosion, Protection of metals from corrosion – organic and inorganic materials, Inhibitors, Cathodic protection.

Adsorption : Definition of terms, Types of adsorption (physical, chemical and their difference), Types of adsorption isotherms (5 types), Derivation of Freundlich adsorption isotherm, Derivation of Langmuir adsorption isotherm, Applications of adsorption

Catalysis : Characteristic of catalysis, Homogenous and heterogeneous catalysis, Enzymecatalysed reaction and derivation mechanism, Marten reaction

Phase Rule : Theoretical derivation of phase rule; One component system : water system and sulphur system; Condensed phase rule; Silver – lead (Ag-Pb) system;

Polymer Chemistry : Definition, Monomer, Polymer, Polymerization, Classification of Polymers; Chain polymerization: Free radical and Ionic polymerization [cationic and anionic], Coordination polymerization, Step polymerization: Polycondensation and Polyaddition and Ring Opening Polymerization.

Spectroscopy : Basic Theory and Concepts of Atomic & Molecular Spectroscopy.

Sources of radiation: their utility and limitations- conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity, x-rays and x-rays. Laser (He, Ne, Argon ion, dye lasers, semiconductor lasers),

Interaction of radiation with matter : reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters.

Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc. Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra.

Elements of X- ray spectrometry- : fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Augur effect

Ultraviolet Spectroscopy: Origin of UV Spectra, Principle, Electronic transition (σ - σ^* , n - σ^* , π - π^* and n - π^*), relative positions of λ_{\max} considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples). Aromatic and Polynuclear aromatic hydrocarbons.

Visible Spectroscopy: Introduction, Beer Lambert's law, instrumentation (light source, optical system, wavelength selector, light sensitive device), Accuracy and error of Spectrophotometry, Application in Forensic Chemistry.

Infrared Spectroscopy: Molecular spectra: qualitative discussions of molecular binding, molecular orbital, types of molecular energies qualitative discussions of rotational, vibrational and electronic spectra, spectra of polyatomic molecules IR spectroscopy- correlation of infra red spectra with molecular structure, Fourier Transform, infrared and Raman spectroscopy, fluorescence and phosphorescence spectrophotometry..Study of Conventional IR and FT-IR.

Raman Spectra : Basic principal, Instrumentation, Application of Raman spectra, Comparison of IR and Raman spectra.

Mass Spectrometry : Theory; Ionization techniques, Ion separating techniques; Different types of ions and their significance in mass spectra, Fragmentation rules and rearrangements; Instrumentation and applications of mass spectrometry. Detail study of GC-MS .

Chromatographic techniques: General principles, function and application of following chromatography, Paper chromatography, Column chromatography, TLC, Adsorption chromatography, Partition chromatography, Gas chromatography, Ion-exchange chromatography and Affinity chromatography(HPLC) etc.

Alkaloids Classification, General method of determining structure, analytical and synthetic methods, structure of Nicotine, Atropine Papaverine, Morphine and codeine.

Synthetic Dyes Classification of Dyes- Anionic and Cationic dyes, Mordant and Vat dyes, Reactive and Dispersed dyes, Synthesis of Alizarin, Malachite green, Indigo, Congo red, Eosin.

Synthetic Drugs: Definition , Synthesis of drugs, Antiseptics, Halogenated compounds, Antimalarials, Quinoline derivatives, Antibacterials, Sulpha Aspirin, Phenacetin, Paracetamol, Sulphanilamide, Sulphaguanidine, Chloromycetin, Chloroquine.

Errors and treatment of Analytical data: Definition terms of mean and median. Precision standard deviation, relative standard deviation. Accuracy, absolute error, relative error. Types of error in experimental data determination (systematic), indeterminate (or random) and gross. Sources of errors and its effects upon the analytical results. Methods for reporting analytical data, Statistical evaluation of data indeterminate error, The uses of statistics.

Forensic Science : Introduction to Forensic science, Definition and Scope of Forensic Science, History and development of Forensic science.

Explosives : Theory, Classification, chemical properties, Explosion mechanism, Preparation of RDX, PETN, Nitroglycerine, Tetryl, ANFO, Home made explosives [IEDs]

Petroleum Chemistry: Occurrence- Composition of Crude oil- Distillation of the Crude oil, Cracking, Knocking, Octane number & Cetane number, Synthetic petrol.
Forensic analysis of petroleum products :

1. Petrol, Kerosene, Diesel, ATF, Lubricating Oil, Furnace oil, Grease and Solvents and Bio diesel as per IS Standard methods.

Alcohol & Alcoholism : Introduction, fermentation processes, conditions for fermentation- ethyl alcohol from molasses, characteristics of enzymes, alcoholic beverages, manufacture of beer, manufacture of spirits, manufacture of wines, manufacture of power alcohol, importance of power alcohol as a fuel, Chemistry and Bio chemistry of Ethyl and Methyl Alcohol, Physiological effect of Alcohol and Alcohol poisoning.

Fire and Arson:- Chemistry of fire, definition, scientific investigation and evaluation of clue materials, analysis of arson exhibits by instrumental methods, managements of arson cases.

Steroids : Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of cholesterol, Bile acids. Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of steroids.

PH Metry : Water, pH, Buffers, pH meter Properties of water, Water a biological solvent, Fitness of the aqueous environment for living organisms, self Ionization of water: K_w and pK_w . Acid, base, ampholytes, pH, pOH, pKa, weak and strong acids, Physiological importance of pH.

Buffers, buffer action, buffer capacity, Henderson – Hasselbalch equation, its limitations and uses, laboratory use of buffers, physiological importance of buffers in body fluids and tissues.

Measurement of pH: indicators, pH meter, different types of electrodes, advantages and disadvantages of different electrodes, principle, working, application, factors affecting pH determination.

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Fundamentals of Organic Reactions:-

Fission of covalent bond, types of reagents, Substitution Nucleophilic Unimolecular reaction mechanism (SN1), Substitution Nucleophilic Bimolecular reaction mechanism (SN2), Electrophilic Aromatic Substitution –Elementary treatment only (Nitration, Sulfonation, Halogenation & Friedel-Crafts Alkylation and Acylation)

Alkanes:- (Saturated Hydrocarbons)

Introduction, IUPAC nomenclature, Reduction of R-X, Woortz's reaction, Hydrolysis of R-Mg-X, Decarboxylation of acid, Kolbe's electrolytic process, Free radical mechanism (Chlorination of Methane).

Alkenes & Alkynes:- (Unsaturated Hydrocarbons)

Introduction, IUPAC nomenclature, Preparations (dehydration, dehalogenation, dehydro halogenation), Reactions with H₂, X₂, HX, HOCl, H₂SO₄, and Hydroboration; Oxidation reactions: (i) with cold alkaline KMnO₄ (Bayer's reagent), (ii) Oxidative cleavage with acidified or hot KMnO₄, (iii) Ozonolysis(O₃); Polymerization; Reactions of terminal Acetylenes: (i) Addition of water,(ii) Na / liquid NH₃.

Thermodynamics:-

Zeroth law, first law, Second law of thermodynamics; proof of 2nd law (Carnot's Cycle); Entropy, of Gas and calculation of entropy for different processes; Kirchhoff's equation.

Analytical Techniques : Introduction Types of analysis – Physical, Chemical and instrumentation. Physical analysis – Specific gravity, Melting point, Boiling point, Crystallization. Purification of compounds etc. Chemical analysis – Quantitative and Qualitative analysis of organic and inorganic compounds. Instrumental analysis – Spectroscopic, Chromatographic PH measurement, Conductivity, Turbidity etc

Atomic structure : Fundamental particles, Rutherford Model of an atom, Nature of electromagnetic radiation, emission spectrum of hydrogen atom, concept of energy levels (orbits). Drawbacks (weaknesses) of Bohr's model, modern concept of structure of atom (elementary idea only) concept of orbits and orbitals, main four quantum numbers, electronic configuration of elements, Aufbau Principle, Pauli's principle, Hund's rule.

Classification of elements and periodicity in properties: The need of classification of elements, the significance of (i) Mendeleev's periodic law (ii) Atomic number and periodic law, present (modern) form of the periodic table. The IUPAC nomenclature for the elements with Z >100, electronic configuration of the elements and periodic table. Types of elements: s, p, d and f block elements, periodic trends in properties; Ionization energy, electron affinity, atomic radii, valency.

Actinides:- Electron configuration, Oxidation states, Magnetic properties, Color and absorption spectra of actinide ions, actinide contraction, Nuclear synthesis of trans uranic elements, Chain reaction, importance of Uranium, Comparison with lanthanide

Organic compounds with functional group containing nitrogen : Nitro compounds : Electronic structure of nitro group, nomenclature, important method of preparation, physical properties and chemical reactions. Amine compounds : Electronic structure of primary, secondary and tertiary amine group, nomenclature, important method of preparation, physical properties, basic character of amine, chemical reactions, separation of primary, secondary and tertiary amines. Diazonium salt Preparation and chemical reactions of benzene diazonium chloride, importance of diazonium salt in synthetic organic chemistry.

Fundamental of Forensic Science & Basic Principles and significance of Forensic Science

Nature and Scope of Biochemistry : What is biochemistry, development of biochemistry, What is biochemical approach, scope of biochemistry, applications of biochemistry, Biochemical literature

Carbohydrates :

classification, monosaccharide, structures of pentose and hexose's. anomeric carbon, mutarotation, simple chemical reactions of glucose, disaccharides : reducing and non reducing sugars-sucrose, maltose and lactose, polysaccharides : elementary idea of structures of starch and cellulose.

Metals, Alloys and Corrosion: Introduction, Physical properties of metals, Definition and purpose of alloy, Classification of alloys. Alloys Steel and its applications. Non-Ferrous alloys and its industrial applications. Introduction to Corrosion, Theories of corrosion, Protection of metals from corrosion – organic and inorganic materials, Inhibitors, Cathodic protection.

Cements: Introduction, Classification of cement and properties, chemical composition of cement, Standards, Manufacturing of Portland cement, chemical constituents of Portland cement, Setting and hardening of cement, PCC & RCC.

Polymers : Classification of polymers, General method of polymerization addition and condensation, free radical, cationic and anionic polymerization, copolymerization, natural rubber, vulcanization of rubber, synthetic rubbers. (examples of monomer only) condensation polymer, molecular mass of polymers (high lightening level of complexity only), Bio polymers, and biodegradable polymers, some industrially important polymers.

Basics of drugs and formulation analysis : Weights, balances, importance of analysis, quality control and quality assurance, analytical methods (classification, validation parameters), requirements – chemicals (types, purification, checking purity), glass wares (types, calibration, cleaning), sampling techniques, sampling error minimization. Units of concentrations. Errors science, errors minimization.

Volumetric analysis (Titrimetric analysis) :

1. Acid-base titrations: Relative strength and its effect on titration, common ion effect, pH, HendersonHasselbach equation, buffers, neutralization curve, acid bas indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action.
2. Redox titrations : Theory of redox titrations, redox indicators, types of redox titrations, iodometry, cerrimetry, mercury metry, diazotization nitrite titrations, 2,6-dichlorophenol indophenol titrations, titration curve and calculations of potentials during course of titrations.
3. Argentometric or precipitation titrations : Mohrs, Fajans and Volhard methods
4. Nonaqueous titrations : Nonaqueous solvents, titrants and indicators. Differentiating and leveling solvents.

5. Complexometric titrations : Theory of the titrations, titrant, indicators and pharmacopoeial applications.

6. Miscellaneous titrations : Karl-Fischer titrations, Kjeldahl method.

Gravimetric analysis : Stability, solubility products, types of precipitations, precipitation techniques, pharmacopoeial applications

SCIENTIFIC ASSISTANT PHYSICS GROUP

SYLLABUS

Atomic Spectroscopy

Hydrogen atom spectrum, Orbital magnetic moment of hydrogen, Larmor precession, Stern-Garlach experiment, Electron spin, The vector atom model, Spin-orbit interaction and fine structure, Pauli's exclusion principle and electronic configuration, Total angular momentum in many electron atoms, L-S coupling, j-j coupling, Hund rules, Energy levels and transitions of Helium, Alkali spectra, Shielding of core electrons, Spectral terms of equivalent electrons, Normal Zeeman effect, experimental arrangement and theory, Anomalous Zeeman effect, Paschen-Bach effect, Stark effect, Characteristics X-ray spectrum, Moseley's law, Width of spectral lines.

Optics

Fermat's principle and its applications: Fermat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

Polarization of light & double refraction

Plane polarized light, pictorial representation of light vibrations, method to produce plane polarized light (only names), double refraction or birefringence, geometry of calcite crystal, Optical axis principal section & principal plane, Nicol prism, Parallel & Crossed Nicol prism, Huygen's theory of double refraction in uniaxial crystals, refractive indices for o-rays & e-rays, Polaroids.

Production & Analysis of Polarized light

Introduction, superposition of two plane polarized waves having perpendicular vibrations, The elliptically & circularly polarized light, quarter wave plate, half wave plate, production of plane elliptically & circularly polarized light, detection of plane elliptically & circularly polarized light, systematic analysis of polarized light

Types of Molecular Spectra and Molecular Energy States

Separation of electronic and nuclear motion The Born Oppenheimer approximation, types of molecular spectra.

Pure Rotational Spectra

Salient features of Rotational spectra, Molecular requirement for rotation spectra, experimental arrangement, Molecule as a rigid rotator, explanation of rotational spectra (without the process of solving Schrodinger equation to get energy formula), the non-rigid rotator, Isotope effect on rotational spectrum, tunable laser and pulse laser - introduction

Vibrational - Rotational Spectra

Salient features of vibrational - Rotational spectra, Molecule as a harmonic oscillator, Molecule as anharmonic oscillator, Vibrational frequency and force constant for anharmonic oscillator, Fine structure of Infrared bands: Molecule as vibrating rotator, Diatomic molecule as symmetric top, Thermal distribution of vibrational and rotational levels

Raman Spectra

Nature of the Raman spectra, experimental arrangement for Raman spectra, Classical theory of Raman effect, Quantum theory of Raman effect, Raman spectra

and Molecular structure, Infrared spectra versus Raman spectra, Laser as intense source.

Classification of Molecular Electronic States

Molecular electronic states, Symmetry properties of electronic Eigen functions (symmetry classification of electronic states)

Fluorescence and Phosphorescence

Luminescence, Mechanism of fluorescent emission, Mechanism of phosphorescent emission, Fluorescence spectrum compared with Raman spectrum.

Alpha Rays

Range of alpha particles, Disintegration energy of the spontaneous alpha decay, Alpha decay paradox - barrier penetration.

Beta Rays

Introduction, Continuous Beta ray spectrum - difficulties encountered to understand it, Pauli's Neutrino Hypothesis, Fermi's theory of Beta decay, the detection of neutrino, Parity non-conservation in Beta decay.

Gamma Rays

Introduction, Gamma-ray emission – selection rules, Internal conversion, Nuclear isomerism.

The liquid drop model of the nucleus

Introduction, Binding energies of nuclei : plot of B/A against A ., Weizsacher's semi empirical mass formula Mass parabolas: prediction of stability against Beta decay for members of an isobaric family, Stability limits against spontaneous fission, Barrier penetration - decay probabilities for spontaneous fission, Nucleon emission.

Introduction to Nanomaterials

Introduction to nano-sized materials and structures, Definitions of nanomaterials, Brief history of Nanomaterials and challenges in Nanotechnology, Properties of Nanomaterials: Effect of reduction of dimensions, quantum size effects, Mechanical, Thermal, Optical and Magnetic properties of nanomaterials

Field effect transistor amplifier

Advantages and disadvantages of the FET, Basic construction of the JFET, Characteristics curve of the JFET, Principle of operation of the JFET, Effect of the VDS on channel conductivity, Channel ohmic region and pinch off region. Characteristics parameters of the FET, Common source AC amplifier

Operational Amplifier

The basic operational amplifier, the differential amplifier, offset error voltages and currents, the basic operational amplifier application

Diode Characteristics

Open –Circuited p-n Junction, p-n Junction as a Rectifier, Current Components in a p-n Diode, Volt-Ampere Characteristic, Temperature Dependence of the V/I Characteristic, Diode Resistance, Space Charge, Transition Capacitance, Charge-Control Description of a Diode , Diffusion, Capacitance , Junction Diode Switching Times, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, Photovoltaic Effect, Light –Emitting Diodes

Power Circuits and Systems

Class A large Signal Amplifiers, Second Harmonic Distortion, Higher –Order Harmonic Generation, Transformer Coupled Audio Power Amplifier, Efficiency, Push-Pull Amplifiers, Class B Amplifiers, Class AB Operation, Regulated Power Supplies, Series Voltage Regulator

Basic Computer Organization and Design

Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit.

Introduction to Data Structure

Data Management concepts, Data types – primitive and nonprimitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures.

Binary System

Digital computer and digital systems, Binary Number, Number base conversion Octal and Hexadecimal Number, complements, Binary Codes, Binary Storage and register, Binary Logic, Integrated Circuit

Boolean Algebra and Logic Gates

Basic Definition, Axiomatic Definition of Boolean Algebra, Basic Theorem and Properties of Boolean Algebra, Minterms And Maxterms, Logic Operations, Digital Logic Gates, IC digital Logic Families

Simplification of Boolean Functions

Different types Map method, Product of sum Simplification, NAND or NOR implementation, Don't Care condition, Tabulation method

Introduction to Operating System

What is an OS?, Evolution Of OS, OS Services, Types Of OS, Concepts of OS, Different Views Of OS, Concepts of OS

Process Management

Process, Process Control Block, Process States, Threads, Types of Threads, Multithreading.

Input Output Management Principles of Input/Output H/W

I/O Devices, Device Controllers, Direct Memory Access, Principles Of Input/Output S/W: Goals Of The I/O S/W, Interrupt Handler, Device Driver, Device Independent I/O Software Disks : RAID levels, Disks Arm, Scheduling Algorithm, Error Handling

Security

Security Environment, Design Principles of Security, User Authentication, Protection Mechanism: Protection Domain, Access Control List

Unix/Linux Operating System

Development Of Unix/Linux, Role Of Kernel & Function Of Kernel, System Calls, Elementary Shell Programming, Directory Structure, System Administration

Electronic evidence:

Tracing an IP address or domain name. How e-mail works. Time stamping, Basics of Network Devices, Modem, Router, Switch, Hub, Repeater

LABORATORY TECHNICIAN PHYSICS GROUP

SYLLABUS

Farmat's principle and its applications

Farmat's principle of least time, laws at reflection, laws of refraction.

LASERS

Introduction, Attenuation of light in an optical medium, Thermal equilibrium, Interaction of light with matter, Einstein coefficients and their relations, Light amplification, Meeting the three requirements, Components of Laser, Lasing action, Principal pumping schemes, Type of lasers, Semiconductor laser, Laser beam characteristics, Applications

Interference in thin films

Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

Solid state electronics Devices

Zener diode, zener diode specification, the voltage regulator circuit, design of a voltage regulator circuit, effect of supply voltage variation, zener break down mechanism, the tunnel diode, application of tunnel diode, the silicon controlled rectifier, Uni junction transistor Logic gates (OR, AND, NOT, NAND and OR), Primary concept of I.C., PN junction, Semiconductors, Photo diode.

Atomic Spectroscopy

Hydrogen atom spectrum, Orbital magnetic moment of hydrogen, Larmor precession, Stern-Garlach experiment, Electron spin, The vector atom model, Spin-orbit interaction and fine structure, Pauli's exclusion principle and electronic configuration, Total angular momentum in many electron atoms, L-S coupling, j-j coupling, Hund rules, Energy levels and transitions of Helium, Alkali spectra, Shielding of core electrons, Spectral terms of equivalent electrons, Normal Zeeman effect, experimental arrangement and theory, Anomalous Zeeman effect, Paschen-Bach effect, Stark effect, Characteristics X-ray spectrum, Moseley's law, Width of spectral lines.

Polarization of light & double refraction

Plane polarized light, pictorial representation of light vibrations, method to produce plane polarized light (only names), double refraction or birefringence, geometry of calcite crystal, Optical axis principal section & principal plane, Nicol prism, Parallel & Crossed Nicol prism, Huygen's theory of double refraction in uniaxial crystals, refractive indices for o-rays & e-rays, Polaroids.

Production & Analysis of Polarized light

Introduction, superposition of two plane polarized waves having perpendicular vibrations, The elliptically & circularly polarized light, quarter wave plate, half wave plate, production of plane elliptically & circularly polarized light, detection of plane elliptically & circularly polarized light, systematic analysis of polarized light

DC Circuits

RL circuits (Growth and decay of current), RC circuit (Charging and discharging of capacitor) L-C-R circuit in series with DC source.

AC Bridges

Condition for bridge balance, Maxwell bridge, Hay bridge, Schering bridge, Wein bridge

Types of Molecular Spectra and Molecular Energy States

Separation of electronic and nuclear motion The Born Oppenheimer approximation, types of molecular spectra.

Pure Rotational Spectra

Salient features of Rotational spectra, Molecular requirement for rotation spectra, experimental arrangement, Molecule as a rigid rotator, explanation of rotational spectra (without the process of solving Schrodinger equation to get energy formula), the non-rigid rotator, Isotope effect on rotational spectrum, tunable laser and pulse laser - introduction

Vibrational - Rotational Spectra

Salient features of vibrational - Rotational spectra, Molecule as a harmonic oscillator, Molecule as anharmonic oscillator, Vibrational frequency and force constant for anharmonic oscillator, Fine structure of Infrared bands: Molecule as vibrating rotator, Diatomic molecule as symmetric top, Thermal distribution of vibrational and rotational levels

Alpha and Beta Rays: Alpha Rays

Range of alpha particles, Disintegration energy of the spontaneous alpha decay, Alpha decay paradox - barrier penetration. **Beta Rays:** Introduction, Continuous Beta ray spectrum - difficulties encountered to understand it, Pauli's Neutrino Hypothesis, Fermi's theory of Beta decay, the detection of neutrino, Parity non-conservation in Beta decay

Gamma Rays

Introduction, Gamma-ray emission - selection rules, Internal conversion, Nuclear isomerism.

The liquid drop model of the nucleus

Introduction, Binding energies of nuclei : plot of B/A against A ., Weizsacher's semi empirical mass formula Mass parabolas: prediction of stability against Beta decay for members of an isobaric family, Stability limits against spontaneous fission, Barrier penetration - decay probabilities for spontaneous fission, Nucleon emission.

Introduction to Nanomaterials

Introduction to nano-sized materials and structures, Definitions of nanomaterials, Brief history of Nanomaterials and challenges in Nanotechnology, Properties of Nanomaterials: Effect of reduction of dimensions, quantum size effects, Mechanical, Thermal, Optical and Magnetic properties of nanomaterials

Atomic & Molecular Spectroscopy

Basic spectroscopy, electromagnetic spectrum, Sources of radiation; their utility and limitations- conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity, x-rays and x-rays. Laser (He, Ne, Argon ion, dye lasers, semi conductor lasers)

Radiation

Interaction of radiation with matter: reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters. Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc. Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra. Elements of X-ray spectrometry- fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Auger effect.

Electronic evidence

Crime scene document, Evidence collection, Tracing an IP address or domain name. Investigations involving E-mail, How e-mail works. Time stamping, Basics of Mobile phone, Guide line for call data record analysis.

Introduction

What is an OS?, Evolution Of OS, OS Services, Types Of OS, Concepts of OS, Different Views Of OS, Concepts of OS

Input Output Management Principles Of Input/Output H/W

I/O Devices, Device Controllers, Direct Memory Access, Principles Of Input/Output S/W : Goals Of The I/O S/W, Interrupt Handler, Device Driver, Device Independent I/O Software Disks : RAID levels, Disks Arm, Scheduling Algorithm, Error Handling

Security

Security Environment, Design Principles Of Security, User Authentication, Protection Mechanism: Protection Domain, Access Control List

Unix/Linux Operating System

Development Of Unix/Linux, Role Of Kernel & Function Of Kernel, System Calls, Elementary Shell Programming, Directory Structure, System Administration

LABORATORY ASSISTANT PHYSICS GROUP

SYLLABUS

Atomic & Molecular Spectroscopy

Basic spectroscopy, electromagnetic spectrum

Sources of radiation; their utility and limitations- conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity, x-rays and x-rays. Laser (He, Ne, Argon ion, dye lasers, semiconductor lasers)

Radiation

Interaction of radiation with matter: reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters

Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc.

Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra. Elements of X-ray spectrometry- fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Auger effect

Static Electricity

Friction electricity, Charges and their conservation, Coulomb's law-forces acting between two point charges, forces acting among many charge, principle of superposition and continuous charge distribution.

Conductors and insulators

Presence of free and bound charges, Dielectric and electric polarization, General idea of capacitor and capacitance, Series and parallel connection of capacitors, Energy stored in capacitors, Capacitance of a parallel plate capacitor in absence and presence of dielectric, Van de Graff generator

Electric field and its physical interpretation

Electric field of a point charge, electric lines of force, electric dipole, Electric field of dipole and its behaviour in a uniform electric field.

Electric potential

Physical meaning, Electric potential due to a dipole and system of charges, Equipotential surfaces, Electric potential energy of system of two point charges and electric potential energy of an electric dipole in a static electric field.

Statement of Gauss's Theorem

about electric flux and to find electric field in case of (1) linear, charge distribution of infinite length (2) uniformly charged infinite plane (3) uniformly charged spherical shell (inside and outside the shell)

Kirchhoff s laws

Explanation with an illustration, Whetstone's bridge and its use for the measurement of temperature, meter bridge- a special case of Whetstone's bridge. Potentiometer- principle and its use to measure potential difference and to compare e.m.fs. of two cells.

Electric power

Thermal effect of electric current and Joule's law, chemical effects of electric current- Faraday's laws. of electrolysis, charging of a lead storage cell, solid state cells.

Thermo electricity

Origin, basic ideas of Seebeck, Thomson and Peltier effect, thermo couple, thermoe.m.f., neutral and inversion temperatures. A coil carrying current as a magnetic dipole and its dipole moment, dipole moment of an electron performing circular motion, magnetic field due to a magnetic dipole (bar magnet)- on its axial and equatorial lines, lines of force of uniform magnetic field, Earth's magnetic field and magnetic elements, para, dia and ferromagnetic substances with examples and permanent magnets.

A.C. currents

Peak and r.m.s. values of alternating current and voltage, reactance, impedance, LC oscillations, LCR series circuit(phasor) - resonance circuits. Q factor, power in AC circuits, watt-less current. A.C. generator and transformer

Optical devices

Compound microscope, astronomical telescope and their magnification power. Wave front and Huygen's principle, reflection and refraction of plane waves from plane surfaces using wave front (qualitative idea), interference- young's double slit experiment and equation of width of fringes, coherent sources and stationary interference, diffraction- diffraction by a single slit, width of central maximum, difference between interference and diffraction, resolving power of microscope and telescope, polarization- plane polarized light, Nicole prism, Brewster's law, Uses of plane polarized light and Polaroid.

Photoelectric effect

Einstein's equation of photoelectric effect, particle nature of light, photocell and its uses. Matter waves wave nature of particles, De Broglie's equation, De Broglie wavelength of electron, Division Germer's experiment. Primary concept of electron microscope

Radioactivity

A, P and γ radiations and their properties law of radioactive disintegration half life and decay constant, simple explanation of (X, α and β decay, nuclear reactions- nuclear fission and fusion, energy sources of stars)

Communication System

Primary concepts of Analogue and digital communication, Necessity of modulation, Simple amplitude modulation and detection, quality of digital communication, Data transmission and reception, Principle of fax and modem, Space communication- sky and space wave propagation, Satellite communication, Use in remote sensing. Line communication, Two wire lines, Cables, Telephone links, Optical communication (Optical fiber, use of laser), basic principle of light modulation.

Semiconductor Device

Zener diode, Logic gates (OR, AND, NOT, NAND and OR), Primary concept of I.C., PN junction, Semiconductors, Photo diode.

Fermat's principle and its applications:

Fermat's principle of least time, laws of reflection, laws of refraction.

LASERS

Introduction, Attenuation of light in an optical medium, Thermal equilibrium, Interaction of light with matter, Einstein coefficients and their relations, Light amplification, Meeting the three requirements, Components of Laser, Lasing action, Principal pumping schemes, Type of lasers, Semiconductor laser, Laser beam characteristics, Applications

Interference in thin films:

Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

DC Circuits :

RL circuits (Growth and decay of current), RC circuit (Charging and discharging of capacitor) L-C-R circuit in series with DC source.

AC Bridges:

Condition for bridge balance, Maxwell bridge, Hay bridge, Schering bridge, Wein bridge

JUNIOR EXPERT FPB GROUP

SYLLABUS

Electric potential

physical meaning, Electric potential due to a dipole and system of charges, Equipotential surfaces, Electric potential energy of system of two point charges and electric potential energy of an electric dipole in a static electric field.

Statement of Gauss's Theorem

about electric flux and to find electric field in case of (1) linear, charge distribution of infinite length (2) uniformly charged infinite plane (3) uniformly charged spherical shell (inside and outside the shell)

Electromagnetic induction, Faraday's law, induced e.m.f and current, Lenz's law, Eddy currents, self and mutual induction. A.C. currents, peak and r.m.s. values of alternating current and voltage, reactance, impedance, LC oscillations, LCR series circuit(phasor) - resonance circuits. Q factor, power in AC circuits, watt-less current.

Electromagnetic waves

Characteristics (qualitative), transverse nature of electromagnetic waves. Electromagnetic spectrum (radio, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays and primary information about their uses, propagation of electromagnetic waves in atmosphere.

Reflection

spherical mirrors, formula of mirror, refraction of light, total internal reflection and its uses, spherical lens, equation of a thin lens, lens-maker formula, magnification, power of a lens, combination of thin lenses in contact, refraction and dispersion of light by a prism, spectrometer and its use to measure refractive index of the material of prism, rainbow, scattering of light, blue color of sky, crimson color of sky at sun rise and sun set.

Optical devices

Compound microscope, astronomical telescope and their magnification power. Wave front and Huygens's principle, reflection and refraction of plane waves from plane surfaces using wave front (qualitative idea), interference- young's double slit experiment and equation of width of fringes, coherent sources and stationary interference, diffraction- diffraction by a single slit, width of central maximum, difference between interference and diffraction, resolving power of microscope and telescope, polarization- plane polarized light, Nicole prism, Brewster's law, Uses of plane polarized light and Polaroid.

Fermat's principle and its applications

Fermat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

LASERS: Introduction, Attenuation of light in an optical medium, Thermal equilibrium, Interaction of light with matter, Einstein coefficients and their relations, Light amplification, Meeting the three requirements, Components of Laser, Lasing action, Principal pumping schemes, Type of lasers, Semiconductor laser, Laser beam characteristics, Applications

Adsorption

physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis; homogenous and heterogeneous, activity and selectivity; enzyme

catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic, multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsion types of emulsions.

Haloalkanes

Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions.

Haloarenes

Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only) Uses and environmental effects of - dichloro methane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

Alcohols

Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, some important compounds - methanol and ethanol.

Phenols

Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols. Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

Aldehydes and Ketones

Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Organic compounds containing Nitrogen

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines. Cyanides and Isocyanides - will be mentioned at relevant places in context. Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Polymers Classification

Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, rubber.

Chemicals in medicines

Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food

Preservatives, artificial sweetening agents.

Cleansing agents

Soaps and detergents, cleansing action.

Alkanes

(Saturated Hydrocarbons) Introduction, IUPAC nomenclature, Reduction of R-X, Wurtz's reaction, Hydrolysis of R-Mg-X, Decarboxylation of acid, Kolbe's electrolytic process,

Free radical mechanism (Chlorination of Methane).

Alkenes & Alkynes

(Unsaturated Hydrocarbons), Introduction, IUPAC nomenclature, Preparations (dehydration, dehalogenation, dehydrohalogenation), Reactions with H₂, X₂, HX, HOCl, H₂SO₄, and

Hydroboration; Oxidation reactions: (i) with cold alkaline KMnO₄ (Baeyer's reagent), (ii) Oxidative cleavage with acidified or hot KMnO₄, (iii) Ozonolysis (O₃); Polymerization; Reactions of terminal Acetylenes: (i) Addition of water, (ii) Na / liquid NH₃.

Cell as a functional unit

Composition of protoplasm; water relations; Absorption and conduction (Diffusion, osmosis, plasmolysis, permeability, water potential, absorption)

Theories of ascent of sap

Root pressure, suction force transpiration - importance. Factors affecting rate of transpiration; mechanism of stomatal opening and closing; (Potassium ion theory); factors affecting movement of guard cells.

Photosynthesis

Significance, site of photosynthesis (functional importance of chlorophyll structure) photochemical and bio synthetic phases. Electron transport system;

Nutrition and its types, nutrients food and vitamins

Human skeleton, axial and appendicular, Cranium and cage bones; Joints and their types Bone, Cartilage and their disorders (Arthritis, osteoporosis) Mechanism of muscle contraction. Nervous system of Cockroach and humans.

Cellular growth

Growth rate, growth map, growth - regulation and hormones; Mechanism and types of- regeneration. Ageing - cellular and extra cellular changes, principles of ageing.

Population, environment and development

Population growth and factors (Vitality, mortality, immigration, emigration, age and sex ratio)

Diversity and Classification of the plant kingdom

Classification of kingdom and the criteria

(According to Mayr, the seven kingdom of living organism.);

Diversity in habitat, form, life span, Nutrition and Ecological status of Plants.

Cyanobacteria

General account of Cyanobacteria.

Study of life history and economic importance of blue-green algae

Spirulina

Algae

Classification (As per F.E.Fristch), life history and economic importance of: Volvox,

Classification (As per F.E.Fristch), life history and economic importance of: Spirogyra.

Classification (As per F.E.Fristch), life history and economic importance of: Oedogonium ,

Classification (As per F.E.Fristch), life history and economic importance of: Ectocarpus.

Fungi

Classification (As per Ainsworth), life history and economic importance of Mastigomycotina Phytophthora,

Classification (As per Ainsworth), life history and economic importance of Zygomycotina: Mucor,

Classification (As per Ainsworth), life history and economic importance of Ascomycotina: Saccharomyces (Yeast)

SEARCHER FPB GROUP **SYLLABUS**

Electric potential

Physical meaning, Electric potential due to a dipole and system of charges, Equipotential surfaces, Electric potential energy of system of two point charges and electric potential energy of an electric dipole in a static electric field.

Statement of Gauss's Theorem

About electric flux and to find electric field in case of (1) linear, charge distribution of infinite length (2) uniformly charged infinite plane (3) uniformly charged spherical shell (inside and outside the shell)

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Faraday's law, induced e.m.f and current, Lenz's law, Eddy currents, self and mutual induction. A.C. currents, peak and r.m.s. values of alternating current and voltage, reactance, impedance, LC oscillations, LCR series circuit(phasor) - resonance circuits. Q factor, power in AC circuits, watt-less current.

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Characteristics (qualitative), transverse nature of electromagnetic waves. Electromagnetic spectrum (radio, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays and primary information about their uses, propagation of electromagnetic waves in atmosphere.

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light-spherical mirrors, formula of mirror, refraction of light, total internal reflection and its uses, spherical lens, equation of a thin lens, lens-maker formula, magnification, power of a lens, combination of thin lenses in contact, refraction and dispersion of light by a prism, spectrometer and its use to measure refractive index of the material of prism, rainbow, scattering of light, blue color of sky, crimson color of sky at sun rise and sun set.

Optical devices

Compound microscope, astronomical telescope and their magnification power. Wave front and Huygens's principle, reflection and refraction of plane waves from plane surfaces using wave front (qualitative idea), interference- young's double slit experiment and equation of width of fringes, coherent sources and stationary interference, diffraction- diffraction by a single slit, width of central maximum, difference between interference and diffraction, resolving power of microscope and telescope, polarization- plane polarized light, Nicole prism, Brewster's law, Uses of plane polarized light and Polaroid.

Adsorption

Physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis; homogenous and heterogeneous, activity and selectivity; enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic, multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsion types of emulsions.

Haloalkanes

Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions.

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Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only) Uses and environmental effects of - dichloro methane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

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Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

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Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines. Cyanides and Isocyanides - will be mentioned at relevant places in context. Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Polymers Classification

Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, rubber.

Chemicals in medicines

Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food

Preservatives, artificial sweetening agents.

Cleansing agents

Soaps and detergents, cleansing action.

Cell

Cell as a functional unit, Composition of protoplasm; water relations; Absorption and conduction (Diffusion, osmosis, plasmolysis, permeability, water potential, absorption). Cellular growth Growth rate, growth map, growth - regulation and hormones; Mechanism and types of- regeneration. Ageing - cellular and extra cellular changes; principles of ageing. Theories of ascent of sap - root pressure, suction force transpiration importance. Factors affecting rate of transpiration; mechanism of stomatal opening and closing; (Potassium ion theory); factors affecting movement of guard cells.

Photosynthesis

Significance; site of photosynthesis (functional importance of chlorophyll structure) photochemical and bio synthetic phases. Electron transport system;

Nutrition and its types

Nutrients food and vitamins; digestive system of invertebrate (Cockroach)

Human Anatomy

Human skeleton, axial and appendicular, Cranium and cage bones; Joints and their types Bone, Cartilage and their disorders (Arthritis, osteoporosis) Mechanism of muscle contraction.

Population

Environment and development; Population growth and factors (Vitality, mortality, immigration, emigration, age and sex ratio)

STOREKEEPER SYLLABUS

PHYSICAL WORLD AND MEASUREMENT

Scope and excitement of physics. Physics, technology and society, Fundamental forces in nature, Conservation laws, Examples of the gravitational force, Electromagnetic force and nuclear force from the experiences of day-to-day life. Importance of measurement, Units of measurement, System of units, SI system, Fundamental and derived units, Measurements of length, mass and time, Accuracy and precision of instruments used for measurements, Errors in measurement, Significant figures. Dimensions of physical quantities, Dimensional analysis and its applications.

LAWS OF MOTION

Force and inertia, Newton's first law of motion, momentum, Newton's second law of motion, Impulse of force, Newton's third law of motion, Law of conservation of momentum and its uses, Equilibrium of concurrent forces, Static and dynamic friction, Laws of friction, Rolling friction, Lubrication, Example of variable mass, Dynamics of uniform circular motion, Centripetal force, - Examples of circular motion (Vehicle on a horizontal curved road, vehicle on a banked road Inertial and non-inertial frames of reference (basic concept).

STATES OF MATTER

Gaseous State : Measurable properties of gases, the gas laws, ideal gas equation, kinetic molecular theory, deviation of real gases from ideal behaviour; liquefaction of gases, critical temperature and its importance. Liquid state : Measurable properties of liquids, qualitative description of vapour pressure, surface tension and viscosity. Solid state : Classification of solids based on different binding forces.

ATOMIC STRUCTURE

Fundamental particles, Rutherford Model of an atom, Nature of electromagnetic radiation, emission spectrum of hydrogen atom, :concept of energy levels (orbits). Drawbacks (weaknesses) of Bohr's model, modern concept of structure of atom (elementary idea only) concept of orbits and orbitals, main four quantum numbers, electronic configuration of elements, Aufbau Principle, Pauli's principle, Hund's rule.

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

The need of classification of elements, the significance of (i) Mendeleev's periodic law (ii) Atomic number and periodic law, present (modern) form of the periodic table. The IUPAC nomenclature for the elements with $Z > 100$, electronic configuration of the elements and periodic table. Types of elements : s, p, d and f block elements, periodic trends in properties; Ionization energy, electron affinity, atomic radii, valency..

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Kossel - Lewis approach of bonding, ionic bond lattice structure and energy. Born-Haber cycle, covalent bond - Lewis structure of covalent bond, resonance structures, geometry of molecules, VSEPR model, polarity of bond, electro

negativity, valence bond approach, concept of resonance, directional properties of bond, Hybridization SP, SP₂, SP₃, qualitative approach.

HYDROCARBONS

Classification of hydrocarbons, alkanes and cycloalkanes - IUPAC nomenclature, conformations of alkanes and cycloalkanes (Ethane, propane, butane and cyclohexane), 3D structures and 2D projections (Sawhorse and Newmann) Alkenes and Alkynes : Nomenclature, geometrical isomerism in alkenes, stability of alkenes, general methods of preparation, physical properties, chemical reactions - reactivity, mechanism of electrophilic addition, reactions in alkenes, Markovnikoff's rule, peroxide effect, acidic characteristics of alkynes, polymerization reactions - dienes, concept of delocalization of electrons, addition reaction, in dienes (1,2 and 1,4 addition)

Aromatic hydrocarbons :

Benzene and its homologues, isomerism, IUPAC nomenclature sources of aromatic hydrocarbons, (Coal and petroleum) structure of benzene, resonance, delocalization, concept of aromaticity - an elementary idea. Chemical reactions of benzene, mechanism of electrophilic substitution, reactions, directive effect of substituent and their effect on reactivity, polynuclear hydrocarbons and their toxicity, only reactions of toluene.

Petroleum and petrochemicals:

Composition of crude Oil, fractionation, uses of different fractions, quality of gasoline, LPG and CNG. Cracking and reforming, petrochemicals.

SOLUTIONS

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass.

LIVING WORLD

Biology and its branches; relationships with other sciences; scientific methods in biology; historical break through; scope of biology and career options; characters of living organisms (metabolism, transfer of energy at molecular level, open and closed system), homeostasis, growth and reproduction, adaptation, survival, death)

GENETICS

Continuity of life - heredity, variation, Mendel's laws of inheritance; chromosomal basis of inheritance; other patterns of inheritance - incomplete dominance, epistasis, multiple allelism.

Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes; and chromosomes; genome, linkage and crossing over; gene mapping, recombination; sex chromosomes; sex determination; sex linked inheritance; mutation and structural chromosomal aberrations. Human genetics - methods of study, genetic disorders.

DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis; gene expression - transcription and translation in

prokaryotes and eukaryotic; Regulation of gene expression, induction and repression – Housekeeping genes; nuclear basis of differentiation and development; oncogenes.

Basics of Recombinant DNA technology; cloning; gene bank; DNA finger-printing; genomics - principles and its applications, transgenic plants, animals and microbes.

ECOLOGY AND ENVIRONMENT

Organism and their environment; factors - Air, Water, Soil, temperature, light, biota; range of tolerance; ecological adaptations

Levels of organization - Structure and functions, productivity, energy flow, ecological efficiencies; decomposition and nutrient cycling; major biomes - forests, grass lands and deserts. ecological succession - types and mechanism; Natural resources types and resources. Environment pollution - kinds, sources and abatement of air, water soil and noise pollution. Global environmental changes, green-house effects; global warming; sea level rise and ozone layer depletion. Living resources. Terrestrial, marine and other aquatic resources; biodiversity - benefits and evaluation, threats.

Endangered species, extinctions, conservation of biodiversity (biosphere reserves and other protected areas) National and international efforts both governmental and non governmental; environmental ethics and legislation.

Glassware & Chemicals

Types of Glassware & Chemicals, Certified Reference Materials, classification of hazardous chemicals, Importance of calibration of Glassware and Instruments , storage of chemicals respect to safety & hazardous

ASST. EXAMINER OF QUESTIONED DOCUMENT HPB GROUP

SYLLABUS

Questioned Document and Currency notes

Nature and problems of documents examination, classification of documents, procurements of standard admitted/ specimen writing, handling and marking of document. Preliminary examination of document, basis of handwriting identification, individuality of hand writing, variation in genuine handwriting, natural variation, process of comparison. Various types of documents- genuine and forge documents and holographic documents, various writing feature and estimation, general characteristic of handwriting, individual characteristics of handwriting, basic tools needed for forensic document examination and their use. Identification of writer, examination of signature, writing instrument and their influence on handwriting. Examination of alteration, erasures, overwriting, addition, and obliteration. Types of Forgery, Age of Documents and Sequence of strokes. Identification of Currency notes, counterfeit coins, passport and stamp papers. Hand writing and signature analysis. Document forgery analysis. Examination of indented handwriting. Examination of mechanical, electronic and digital type scripts and printed matters. Examination of security documents (currency notes, stamps, passports, lottery etc.).

Forensic Photography and Material Science

Photography: Basic principles and techniques of black and white and color photography, cameras and lenses, exposing, development and printing, different kinds of developers and fixtures, crime scene and laboratory photography, IR, UV photography.

Material Science: Types of Glue (sticking material), Ink examination and its types with forensic importance.

Different types of Spectroscopy

Atomic absorption spectrometry: Instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis, Thermal analysis methods, Basic principles and theory, differential scanning calorimetry and differential analysis, thermogravimetry, Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and Instrumentation

Crime Scene Management

Introduction, Evaluation and processing of scene of crime. Documenting the scene, Crime scene sketching, Steps in sketching a crime scene. Method of sketching a crime scene. The crime scene search, Crime scene search method, Processing of physical evidence. Discovering, recognizing and examining of physical evidence. Collecting, marking and identifying evidence. Safety measure for evidence collection, Packaging and preserving evidence.

Atomic Spectroscopy

Hydrogen atom spectrum, Orbital magnetic moment of hydrogen, Larmor precession, Stern-Garlach experiment, Electron spin, The vector atom model, Spin-orbit interaction and fine structure, Pauli's exclusion principle and electronic configuration, Total angular momentum in many electron atoms, L-S coupling, j-j coupling, Hund rules, Energy levels and transitions of Helium, Alkali spectra, Shielding of core electrons, Spectral terms of equivalent electrons, Normal Zeeman effect, experimental arrangement and theory, Anomalous Zeeman effect, Paschen-

Bach effect, Stark effect, Characteristics X-ray spectrum, Moseley's law, Width of spectral lines.

Optics

Fermat's principle and its applications: Fermat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.

Polarization of light & double refraction

Plane polarized light, pictorial representation of light vibrations, method to produce plane polarized light (only names), double refraction or birefringence, geometry of calcite crystal, Optical axis principal section & principal plane, Nicol prism, Parallel & Crossed Nicol prism, Huygen's theory of double refraction in uniaxial crystals, refractive indices for o-rays & e-rays, Polaroids.

Production & Analysis of Polarized light

Introduction, superposition of two plane polarized waves having perpendicular vibrations, The elliptically & circularly polarized light, quarter wave plate, half wave plate, production of plane elliptically & circularly polarized light, detection of plane elliptically & circularly polarized light, systematic analysis of polarized light

Types of Molecular Spectra and Molecular Energy States

Separation of electronic and nuclear motion The Born Oppenheimer approximation, types of molecular spectra.

Pure Rotational Spectra

Salient features of Rotational spectra, Molecular requirement for rotation spectra, experimental arrangement, Molecule as a rigid rotator, explanation of rotational spectra (without the process of solving Schrodinger equation to get energy formula), the non-rigid rotator, Isotope effect on rotational spectrum, tunable laser and pulse laser - introduction

Vibrational - Rotational Spectra

Salient features of vibrational - Rotational spectra, Molecule as a harmonic oscillator, Molecule as anharmonic oscillator, Vibrational frequency and force constant for anharmonic oscillator, Fine structure of Infrared bands: Molecule as vibrating rotator, Diatomic molecule as symmetric top, Thermal distribution of vibrational and rotational levels

Raman Spectra

Nature of the Raman spectra, experimental arrangement for Raman spectra, Classical theory of Raman effect, Quantum theory of Raman effect, Raman spectra and Molecular structure, Infrared spectra versus Raman spectra, Laser as intense source.

Classification of Molecular Electronic States

Molecular electronic states, Symmetry properties of electronic Eigen functions (symmetry classification of electronic states)

Fluorescence and Phosphorescence

Luminescence, Mechanism of fluorescent emission, Mechanism of phosphorescent emission, Fluorescence spectrum compared with Raman spectrum.

Alpha Rays

Range of alpha particles, Disintegration energy of the spontaneous alpha decay, Alpha decay paradox - barrier penetration.

Beta Rays

Introduction, Continuous Beta ray spectrum - difficulties encountered to understand it, Pauli's Neutrino Hypothesis, Fermi's theory of Beta decay, the detection of neutrino, Parity non-conservation in Beta decay.

Gamma Rays

Introduction, Gamma-ray emission – selection rules, Internal conversion, Nuclear isomerism.

The liquid drop model of the nucleus

Introduction, Binding energies of nuclei : plot of B/A against A., Weizsacher's semi empirical mass formula Mass parabolas: prediction of stability against Beta decay for members of an isobaric family, Stability limits against spontaneous fission, Barrier penetration - decay probabilities for spontaneous fission, Nucleon emission.

Introduction to Nanomaterials

Introduction to nano-sized materials and structures, Definitions of nanomaterials, Brief history of Nanomaterials and challenges in Nanotechnology, Properties of Nanomaterials: Effect of reduction of dimensions, quantum size effects, Mechanical, Thermal, Optical and Magnetic properties of nanomaterials

Analytical Chemistry:

Introduction, The nature of analytical chemistry, The role of analytical chemistry, Classification of analytical methods (classical and instrumental) Quantitative analytical methods. An internal role for chemical analysis.

Quality Control management System :

Definition of Accreditation, History and development of ISO, Importance of accreditation in Analytical Laboratories, Introduction to Quality, Quality Assurance, Quality control, Quality system, Validation Criteria of new test methods and calibration. GLP concepts.

Narcotic drugs & psychotropic substances: Introduction to Controlled Substances, Classification of controlled substances, Precursor chemicals, Clandestine drug laboratories, Mandatory provisions of NDPS Act, 1985, Commonly abused drugs, Drug dependence, Drug Tolerance, Designer Drugs, Drug profiling, Systematic analysis of Drug of abuse by various chemical and instrumental methods.

Oils and Fat: Introduction, distinction between oils and fats properties, classification, edible oils , manufacture of oil by solvent extraction, animal fats and oils, processing of animal fats and oils, mineral oils, difference between animal, vegetable and mineral oils, hydrocarbon oils and essential oils.

Alkaloids : Classification, General method of determining structure, analytical and synthetic methods, structure of Coniine, Nicotine, Atropine and Papaverine.

Synthetic Dyes : Classification of Dyes- Anionic and Cationic dyes, Mordant and Vat dyes,
Reactive and Dispersed dyes, Synthesis of Alizarin, Malachite green, Indigo, Congo red, Eosin.

Phase Rule : Binary system : Zn-Cd and Pb-Ag ,Zeotropic and azeotropic mixtures, Steam distillation, Zone refining.

Osmosis : Desalination and reverse osmosis, Electro dialysis, Electrochemistry and pollution control, Removal of Cu, Ag and Fe from waste water.

Solvent Extraction Separation: Principles of solvent extraction, choice of solvent, distribution coefficient, distribution ratio, percentage (%) extraction. The extraction process, solvent extraction of metals, selective extraction and separation efficiency.

Nano technology : Introduction and preparation ,Introduction to Nanomaterials, Optical, magnetic and chemical properties of Nanomaterials, Preparation of Nanoparticles: Chemical Approaches: Chemical reduction; Sonochemical synthesis; Sol-Gel Synthesis; Self assembly. Physical Approaches: Aerosol spray; Gas condensation; Laser vaporization and vapour deposition; Sputtering.

Nanostructured materials : Quantum dots, wells & wires; Carbon Nanotubes (CNTs): Single walled carbon nanotubes (SWNTs), Multiwalled carbon nanotubes (MWNTs), Graphenes, Fullerenes, Metal/Oxide nanoparticles (NPs), Nanorods, Nanotubes and Nanofibres, Semiconductor quantum dots, Polymer NPs.

Characterization techniques for Nanomaterials –I :

Particle size Analyser (Laser scattering), Optical Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunnel Microscopy (STM).

Characterization techniques for Nanomaterials-II : X-ray Diffraction (XRD), Auger Emission Spectroscopy, Electron Spectroscopy for Chemical analysis (ESCA)

Application of Nanomaterials: Applications Solar energy conversion and catalysis, Polymers with a special architecture, Liquid crystalline systems, Applications in displays and other devices, Advanced organic materials for data storage, Photonics, Chemical and biosensors, Nanomedicine and Nanobiotechnology.

INSTRUMENTATIONS:

Fundamentals of Spectroscopy: Classification of spectra i.e. line, band, continuous spectra / absorption, emission spectra; Wave properties of electromagnetic radiation; Particle/photon properties of electromagnetic radiation; Electromagnetic spectrum.

UV-VIS Spectroscopy: Theory; Beer and Lambert's law - limitations and deviations from the law; Terminologies associated with absorption measurements; Types of transitions; Factors affecting spectral characteristics (structural and nonstructural); Effect of conjugation; Woodward Fieser rule; Photometric titrations; Instrumentation, applications (in analysis of organic compounds and inorganic complexes), advantages and limitations of UV Visible spectroscopy; Quantitative analysis of binary mixtures of absorbing substances by simultaneous equation method; Calibration of UV Visible Spectrophotometer as per standard methods.

Fluorescence Spectroscopy: Introduction: luminescence, photoluminescence; Theory of Fluorescence and Phosphorescence; Jablonski diagram; Factors affecting fluorescence intensity (structural and nonstructural); Instrumentation, applications, advantages and limitations of fluorescence spectroscopy

IR Spectroscopy: Theory of absorption of Infrared radiation by molecules; Molecular vibrations; Factors influencing vibrational frequencies; Calculation of vibrational frequencies (Hooke's law); Sample handling techniques; Instrumentation (Dispersion and FTIR spectrometer) and applications of IR Spectroscopy; Calibration of IR Spectrophotometer as per Pharmacopoeia.

Atomic Spectroscopy: Basics of atomic spectroscopy; Principle of atomic absorption and atomic emission spectroscopy; Interferences in atomic spectroscopy; Factors affecting atomic spectroscopy like solvents, buffers, other ions, etc; Flame Photometry; Atomic emission spectroscopy with plasma and electrical discharge sources; Instrumentation (including radiation sources like hollow cathode lamp), applications, advantages and limitations of atomic absorption and atomic emission spectroscopy.

Mass Spectrometry: Theory; Ionization techniques, Ion separating techniques; Different types of ions and their significance in mass spectra, Fragmentation rules and rearrangements; Instrumentation and applications of mass spectrometry. Overview of GC-MS and GC-MS-MS, interpretation of results of Isomers.

Nuclear Magnetic Resonance spectroscopy: Fundamental Principles - nuclear spin, magnetic moment; Proton NMR spectroscopy - theory, chemical shift and factors affecting chemical shift, spin- spin coupling, coupling constant, relaxation process, Instrumentation and applications of PMR; Brief overview of C13 NMR.

X-ray spectroscopy Introduction; Generation of X – rays; X-ray diffraction, Bragg's law; Applications of X- ray diffraction, EDXRF: Principle instrumentation, how does it works & Applications of EDXRF.

Raman spectra :Basic principle , Instrumentation , application of Raman spectra , comparison of IR and Raman spectra.

Gas Chromatography : Introduction; Theory and Principle of Gas-Chromatography; Mobile phase, Stationary phases for GSC and GLC; Instrumentation (including temperature programming and derivatization) and applications of GC. Principle and applications of Gas chromatography with Head space Technique .

High Performance Liquid Chromatography : Introduction; Theory, Classification and Principle of HPLC; Mobile phase, Stationary phases for normal and reversed phase HPLC; Instrumentation (including significance of guard column) and applications of HPLC; Comparison of HPLC with GC; Overview of LC-MS, LC-MS/MS. Basic principle, theory and applications of partition, adsorption, ion-exchange, size exclusion, Super critical fluid and Affinity chromatography.

SCIENTIFIC ASSISTANT PSYCHOLOGY GROUP SYLLABUS

PSYCHOLOGY AS A SCIENCE- Definition of Psychology , Historic development of the definition of Psychology, Psychology as a Behavioral Science, Goals of Psychology, Nature of Psychology as a Science, Scope of General Psychology, Broad fields of Psychology

Research Methods & Statistics –

Research Process -Definition,Functions of Research, Value of understanding research process, Steps in Research Process

Research Problem - Selection and Formulation of research problem, Selection of the research subject. Characteristics of a researchable problem, Feasibility of research programmer, Hypothesis-definitions-Sources and types of hypothesis

Principles of Sampling - Concepts and definitions, Sampling techniques, Probability and non-probability Sampling

Experimental method - Meaning - characteristics of an experiment, Meaning of variables, Types of variables, Natural Experiment and Laboratory Experiment, Steps in Experimentation, Experimental Errors, Case study

Survey Method – Meaning of Survey, Stage of Survey Planning, Problems of Survey Planning, Pretest and Pilot Survey , Goals of Social Survey, Problems of Survey planning,

Questionnaire Method - Meaning of Questionnaire, Foundation of Questionnaire, Subject Matter of Question, Importance of Words in Question, Limitations and Benefit of Questionnaire, Open questions and pre-coded questions, Order of questions

Interview Method - Meaning of Interview, Types of Interview, Work of Interviewer Officer, Interview v/s Interrogation

Statistics -

Meaning and Necessity of Studying the Statistics Method , Meaning of Score, Types and Types of Series (Continuous –Discrete), Significant Digit and Approximate Value of Statistical Figures, Frequency Distribution, Preparing a Frequency Distribution Table, Class, Intervals Mid Value, Limit of Class (Levels) , Methods, Histogram, Frequency Polyson, Frequency Curve and Cumulative Frequency Curve, Measures of Central Tendency, What is Measure of Central Tendency, What is mean and Median ? Uses of Mean and Median, Calculating mean and median, Measures of Dispersion, Calculation of Quartile, Explain the Quartile Deviation and Standard Deviation, Calculation of Quartile Deviation, Long and Short Methods of Calculating S.D. From Grouped and Ungrouped Data, Utility of Quartile Deviation and Standard Deviation, Correlations, What is Correlation ? Interpretation of Coefficient of Correlation, Rank Correlation, T-test, NullHypothesis and Significance Level, Testing of Significance

Counselling Psychology - Introduction, Approaches of Counseling, Need of counselling, Counselling relationship, Counselling Interview,Psychoanalysis, Self Approach, Behavioral Approaches, Counseling Process ,Meaning of Counseling Process, Stage of Counseling Process, Effective variable of Counseling Process, 3 Indian Contributions in Counseling, Indian Contribution in Counseling, Yoga, Mediation, Child Counseling, Family Counseling, Counseling in Schools, Career Counseling, Alcohol and Drug Abuse, Group Counseling, Crisis Intervention Counseling, Professional issues and ethics of counsellor,

Experimental Psychology –Experimental Method, Introduction, Meaning and types of Experiment, Variable, Experimental Error, Forms of Behavior, Advantages and Limitations of Experimental Methods, Experiment Design, One group design, Separate group design, Various techniques of Control, Single and Double blind technique, Matching, Randomization, Counter balancing, Psychophysics, types of measurement scales, meaning of psychophysical methods,, the basic concepts and problems in psychophysics, Sensitivity, Threshold, Point of Subjective Equality, Variable and Constant Error Methods of Psychophysics- Minimal changes, Constant Stimuli, Average Error, Ranking and Pair Association, Measurement of Learning, Types of learning, Learning Curves, Higher mental Processes – Concept attachment, Learning concept, Problem solving(Trial and error), Insight in Problem Solving

Physiological Psychology - Introduction to Physiological Psychology, Meaning of Physiological psychology, Discussion of Mentally and Physical Relation, Nature & Scope of Physiological Psychology, Internal Environment of Body, Introduction of Internal Environment of Body, Metabolism,Enzymes, Vitamins, Hormones, Genes, Neuron Cell, Meaning of Neuron Cell – Structure and Function, nerve Impulse, Nervous Systems, Central Nervous System (CNS), Cerebellum Structure and Function, Cerebrum Structure and Function, thalamus & hypothalamus, spinal Cord, Peripheral Nervous System (PNS), Somatic Nervous System, Autonomic Nervous System, Sensory Mechanisms, Motor Mechanism, Physical bases of Perception, Motivation, Emotion (Lie-detection), Adoptive Behavior, Electroencephalograph, Evoked potentials.

Systems and Theory of Personality – Gestaltism, Meaning, Principal of Gestalt Psychology, Laws of Organization in Perception, Contribution of Wertheimer, Kohler, Koffka, Field Theory, Field Theory and Life Space Theory, contribution of Kurt Lewin, Psycho-Analysis-I, Basic Introduction of Psycho-Analysis, Principal of Psycho-Analysis (SigmundFrued) Psycho-Analysis-II , Adler's Individual Psychology, Principals of Psycho-Analysis by Adler, Jung's Analytical Psychology, Contribution of Adler and Jung in Psychology, Hormic Psychology, Introduction of Purposivism, Theory of McDougall

Psychopathology - Introduction of Psychopathology. Meaning Nature and Scope of Psychopathology, What is Abnormality? (Meaning of Abnormal), Characteristics of Normal – Abnormal Personality, causes of abnormal behavior, Physical, Psychological, Socio-cultural, Meaning of Frustration and Stress, Reason and Results of Frustration, Introduction and definition of Defense Mechanism, Function and Types Defence Mechanism, Neurosis, characteristic of Neurosis, types of neurosis, Schizophrenia- causes, types and treatment, Psychosomatic disorders – peptic Ulcer, allergic, asthma, migraine hypertension.

Criminal Psychology - Meaning of Crime Psychology, Nature of Crime Psychology, Types of Crime Psychology, Scope of Crime Psychology, Theory of Crime, Economical Theories, Political Theories, Sociological Theories, Psychological Theories, Reason of Crime – Economic, Political, Sociological Psychological, Juvenile Crime, Meaning of Juvenile Crime and Causes of Juvenile Crime – [1]Social [2] Psychological [3] Economics, Prevention of Crime, model of Crime Prevention

Psychological tests- Definition and Uses of Psychological Testing, Characteristics of a Good Psychological Test, Kinds (Types) of Test, Intelligence Tests,

Intelligence – Definition, Approaches, Measurement, Deficiency, Talent,
Motivation- definition and Nature of Motivation (Motivational Cycles)
Measurement of Motivation, Primary Motives Hunger and Thirst Sex and Maternal Drive, Social Motives, Affection and Affiliation Social approval and Esteem Achievement

Emotion- Definition and Nature of Emotion, Psychological changes during Emotion, Measurement of Automatic changes, Expression of Emotion

Attention- Definition and Nature of Attention, Determinants of Attention

Perception- Meaning of Perception, Object Perception, Perceptual organization, Organizing factors in Perception, Form, Space and depth perception, Illusion and Hallucination

Emotional competence Patterns of Expression & Control of Emotions Understanding & Functioning with Emotions Fostering Constructive Emotions,

Social competence - Main Foundations of Good Interpersonal Relationships, Reorganization of Mutual Purpose, Rights & Responsibilities A Realistic View of Self & Others ,Improving Social Competence Helping to Meet the Needs of Others, Maintaining Ones Own Integrity

Cognitive Psychology - Definition and Nature, Scope & Methods, Important of Cognitive process, Theory of Cognitive Psychology, Contemplation and Problem Solve, Definition, Nature types of Cognitive Lesson, self Contemplation, Realest, Meaning, nature of problems solving, Method aim care of problem solving, The Concept and Memory, Nature and Important of Concept, Type of Concept, Meaning and Steps of Memory, Type of Memory, Creative and logic, definition nature of Creative, Steps of Creativity, Meaning, nature of logic, Types of Logic, Decision making process, difference of Decision making, Self research in decision making, Bias and error in decision making

Psychology of sex and married life – Sex and marriage, Human sexuality, concept of human sexuality- various definitions, the need for education in human sexuality, what is education in human sexuality, marriage- definition, fitness for marriage, types of fitness for marriage, Venereal disease, maturity for marriage, the biology of marriage- male and female, structure and function of male and female sex external and internal organs, Sexual differences and sexual adjustment in marriage, sexual adjustment in marriage, mutability in sexual intercourse, causes of poor sexual adjustments, cultural conditioning of sexual response, strength of sex drive, frequency of coitus, Sexual variants and gender variants, the paraphilias,- fetishism, transvestic fetishism, voyeurism, exhibitionism, sadism, masochism, Gender role, development of role concept, Gender role and stereo type attitude, Gender identity disorders, Gender identity disorders of childhood, transsexuals,

Forensic Psychology

Introduction, Scientific aids to interrogation, Forensic hypnosis, Polygraph (lie detector) technique, Introduction, The instrument, scientific basis of polygraph operation, Testing procedure, Modified polygraph technique, Narco Analysis – An interview technique, Narco interview – technique for crime investigation, Technique of Eliciting Evidence from Brain.

LABORATORY TECHNICIAN PSYCHOLOGY GROUP **SYLLABUS**

PSYCHOLOGY AS A SCIENCE- Definition of Psychology , Historic development of the definition of Psychology, Psychology as a Behavioral Science, Goals of Psychology, Nature of Psychology as a Science, Scope of General Psychology, Broad fields of Psychology

Physiological Psychology - Introduction to Physiological Psychology, Meaning of Physiological psychology, Discussion of Mentally and Physical Relation, Nature & Scope of Physiological Psychology, Internal Environment of Body, Introduction of Internal Environment of Body, Metabolism, Enzymes, Vitamins, Hormones, Genes, Neuron Cell, Meaning of Neuron Cell – Structure and Function, nerve Impulse, Nervous Systems, Central Nervous System (CNS), Cerebellum Structure and Function, Cerebrum Structure and Function, thalamus & hypothalamus, spinal Cord, Peripheral Nervous System (PNS), Somatic Nervous System, Autonomic Nervous System, Sensory Mechanisms, Motor Mechanism, Physical bases of Perception, Motivation, Emotion (Lie-detection), Adoptive Behavior, Electroencephalograph, Evoked potentials.

Systems and Theory of Personality – Gestaltism, Meaning, Principal of Gestalt Psychology, Laws of Organization in Perception, Contribution of Wertheimer, Kohler, Koffka, Filed Theory, Filed Theory and Life Space Theory, contribution of Kurt Lewin, Psycho-Analysis-I, Basic Introduction of Psycho-Analysis, Principal of Psycho-Analysis (Sigmand Frued) Psycho-Analysis-II , Adler's Individual Psychology, Principals of Psycho-Analysis by Adler, Jung's Analytical Psychology, Contribution of Alder and Jung in Psychology, Hormic Psychology, Introduction of Purposivism, Theory of Medougall

Criminal Psychology - Meaning of Crime Psychology, Nature of Crime Psychology, Types of Crime Psychology, Scope of Crime Psychology, Theory of Crime, Economical Theories, Political Theories, Sociological Theories, Psychological Theories, Reason of Crime – Economic, Political, Sociological Psychological, Juvenile Crime, Meaning of Juvenile Crime and Causes of Juvenile Crime – [1]Social [2] Psychological [3] Economics, Prevention of Crime, model of Crime Prevention

Psychological tests- Definition and Uses of Psychological Testing, Characteristics of a Good Psychological Test, Kinds (Types) of Test, Intelligence Tests,

Child Psychology Introduction , definition, and Nature of Child Psychology, Scope of Child psychology, importance of Child Psychology, Method of Child Psychology, Observation, Event Note, autobiography, Growths and Development, Meaning of growth and development, Characteristics of growth and development, Disciplines and Authority, Meaning of Discipline and Authority, Various nature of Home Authority, Characteristics of good Discipline, Characteristics of proper Punishment, Conflicts and Frustration, Meaning of conflicts and Frustration, Reasons of conflicts and Frustration in Child, Remove of Frustration

Cognitive Psychology - Definition and Nature, Scope & Methods, Important of Cognitive process, Theory of Cognitive Psychology, Contemplation and Problem Solve, Definition, Nature types of Cognitive Lesson, self Contemplation, Realest, Meaning, nature of problems solving, Method aim care of problem solving, The

Concept and Memory, Nature and Important of Concept, Type of Concept, Meaning and Steps of Memory, Type of Memory, Creative and logic, definition nature of Creative, Steps of Creativity, Meaning, nature of logic, Types of Logic, Decision making process, difference of Decision making, Self research in decision making, Bias and error in decision making

Social Psychology - Introduction of Method of Social Psychology, Definition, and Nature of Social Psychology, Scope of Social Psychology, Importance of Utility of Social Psychology, Method of Social Psychology, interview Method, Field study Method, Sociometrist Method, Socialization, Definition of Socialization, Process of Socialization, Mediators (Tools) of Socialization, Social Interactions, Meaning and Types of Social Interaction, Assisting (Mechanisms) of Social Interaction, Meaning, Nature and Types of Suggestion, meaning, Nature of Types of Imitation, Social Attitudes, Definition, Nature of Attitude, Formation and Change of Attitude, Measurement of Attitude

Intelligence – Definition, Approaches, Measurement, Deficiency, Talent,
MOTIVATION- definition and Nature of Motivation (Motivational Cycles) Measurement of Motivation, Primary Motives Hunger and Thirst Sex and Maternal Drive, Social Motives, Affection and Affiliation Social approval and Esteem Achievement

EMOTION -Definition and Nature of Emotion, Psychological changes during Emotion, Measurement of Automatic changes, Expression of Emotion

ATTENTION- Definition and Nature of Attention, Determinants of Attention

PERCEPTION- Meaning of Perception, Object Perception, Perceptual organization, Organizing factors in Perception, Form, Space and depth perception, Illusion and Hallucination

PRE-MARTIAL ADJUSTMENT -changing Pre-martial Patterns, Sex Role & Relationship before marriage, Exception of Marriage, Changing Martial Relationship & Exception Reasons for Marriage, Why Some People never Marry, New Standards for Assessing Martial Success, Selecting a Mate, The quest for Romantic Love, Predicting Martial Success Styles & interaction, Factors on good Martial adjustment, Pre-martial Background Factors, Personality Factors, Sexual Adjustment Roles & Mutual Accommodation, Environmental Resources, Limitations & Demands

Psychology of Personal Adjustment Meaning and nature of psychology of personal Adjustment, Characteristics of Adjustment, Characteristics of Satisfactory Adjustment, Scope of Psychology of Personal Adjustment, Importance of the study of Psychology of Personal Adjustment, Adjustment Process, Importance of Adjustment, Family Adjustment, Meaning and Nature of the Family, The Function of Family, The Dynamics of Family Interaction, Adjusting to Family crises, School Adjustment -School as a New Experience, The Home – School Relationship The Teacher – Child Relationship, The Dynamics of learning, Job Adjustment, Marital Adjustment, The Husband – Wife Relationship, the Parent – Child Relationship, Old Age Adjustment, Changes that Occur During the Aging Process ,Sources of Adjustment Difficulties Viewing Old Age Constrictively

EMOTIONAL COMPETENCE Patterns of Expression & Control of Emotions Understanding & Functioning with Emotions Fostering Constructive Emotions,
SOCIAL COMPETENCE Main Foundations of Good Interpersonal Relationships, Reorganization of Mutual Purpose, Rights & Responsibilities A Realistic View of Self & Others ,Improving Social Competence Helping to Meet the Needs of Others, Maintaining Ones Own Integrity

Community Psychology – Introduction, Understanding Community, What is Community, Types of community, Levels of Community, Question and issues defining of Community, A shift of perspective, Seven Basic Value in Community Psychology, Development of Community Psychology, Development of Community Psychology, Personality Science in Psychology, Cultural perspective in Psychology, Social Change and Liberty Movement, Aim of Community Research, Question for Community Research, Community Participation and collaboration in research decision, Method of Community Research, , Quantitative Method

Research Methods & Statistics –

Research Process - Definition, Functions of Research, Value of understanding research process, Steps in Research Process

Research Problem - Selection and Formulation of research problem, Selection of the research subject. Characteristics of a researchable problem, Feasibility of research programme, Hypothesis-definitions-Sources and types of hypothesis

Principles of Sampling - Concepts and definitions, Sampling techniques, Probability and non-probability Sampling

Experimental method - Meaning - characteristics of an experiment, Meaning of variables, Types of variables, Natural Experiment and Laboratory Experiment, Steps in Experimentation, Experimental Errors, Case study

Survey Method – Meaning of Survey, Stage of Survey Planning, Problems of Survey Planning, Pretest and Pilot Survey , Goals of Social Survey, Problems of Survey planning,

Questionnaire Method - Meaning of Questionnaire, Foundation of Questionnaire, Subject Matter of Question, Importance of Words in Question, Limitations and Benefit of Questionnaire, Open questions and pre-coded questions, Order of questions

Interview Method - Meaning of Interview, Types of Interview, Work of Interviewer Officer, Interview v/s Interrogation

Statistics -

Meaning and Necessity of Studying the Statistics Method , Meaning of Score, Types and Types of Series (Continuous –Discrete), Significant Digit and Approximate Value of Statistical Figures, Frequency Distribution, Preparing a Frequency Distribution Table, Class, Intervals Mid Value, Limit of Class (Levels) , Methods, Histogram, Frequency Polyson, Frequency Curve and Cumulative Frequency Curve, Measures of Central Tendency, What is Measure of Central Tendency, What is mean and Median ? Uses of Mean and Median, Calculating mean and median, Measures of Dispersion, Calculation of Quartile, Explain the Quartile Deviation and Standard Deviation, Calculation of Quartile Deviation, Long and Short Methods of Calculating S.D. From Grouped and Ungrouped Data, Utility of Quartile Deviation and Standard Deviation, Correlations, What is Correlation ? Interpretation of Coefficient of Correlation, Rank Correlation, T-test, Null Hypothesis and Significance Level, Testing of Significance

LABORATORY ASSISTANT PSYCHOLOGY GROUP

SYLLABUS

PSYCHOLOGY AS A SCIENCE- Definition of Psychology , Historic development of the definition of Psychology, Psychology as a Behavioral Science, Goals of Psychology, Nature of Psychology as a Science, Scope of General Psychology, Broad fields of Psychology

Biological and Environmental Factor of Behavior - Meaning and process of Heredity, Definition and Type of Environment, Heredity and Environment factors, affect of each

Intelligence – Definition, Approaches, Measurement, Deficiency, Talent, Special ability(nature and measurement)

MOTIVATION, EMOTION, ATTENTION AND PERCEPTION- Definition and Nature

EGO and Personality – ID, Ego and Super ego, Approaches towards Ego and personality, Concept of ego and self, Types of Personality (Type A, Type B, Type C, Personality Bos), Approaches related to study of personality, Special ability, Measurement of personality – projective measures analysis

Group process and Social effects – Introduction and nature of group, formation of group, types of group, factors affecting types of group, acceptance and obedience, effects of group on behavior of an individual, risk, leadership nature and functions, types of leadership

Adjustment - Meaning and nature of psychology of personal Adjustment, Characteristics of Adjustment, Characteristics of Satisfactory Adjustment, Scope of Psychology of Personal Adjustment, Importance of the study of Psychology of Personal Adjustment, Adjustment Process

Stress- types and sources of stress, Coping with stress, Characteristics of the Adjustive demand Characteristics of the Individual Other Key Aspects of stress, Severity of stress, Stress Patterns

Frustration -Sources of Frustration, common frustration in our culture

Conflict -Types of Conflict, common Conflict in our Society

Pressure- Sources of Pressure, common Pressure in our Society

METHODS OF PSYCHOLOGY – Introspection, Observation, Experimental method, Case study, Questionnaire method, Interview method.

Methodology - The Methods of Psychology, Natural and Systematic Observation, Clinical Methods, Survey Method, Experimental Method,

Statistics -Definition of statistics, Types, Concept of Standard deviation and Mean, Concept of Correlation,

PERCEPTUAL PROCESS - Meaning and nature of Perception, Perceptual organization, Organizing factors in Perception, Form, Space and depth perception. Illusion and Hallucination

LEARNING Definition of Learning, Classical Conditioning, Operant Conditioning,

Train and Error, Cognitive Learning (Insight Learning) Acquaintance with the experiments of Pavlov, Thorndike and Kohler. Basic Processes, Acquisition, Reinforcement, Stimulus Generalization, Stimulus discrimination, Extinction, Spontaneous recovery, Transfer of training

MEMORY- Meaning of Memory, Stages of memory, Kinds of memory Forgetting, its explanation, Decay, Interference, retrieval failure, motivated forgetting and amnesia. Measurement of Retention, Factors affecting retention

THINKING AND REASONING- Meaning of thinking, Nature of thinking process, Types of thinking, Formation and meaning of Concept, Reasoning -Types of reasoning. Problem solving approaches, strategies of problem solving.

PSYCHOLOGICAL TESTING- Definition and Uses of Psychological Testing, Characteristics of a Good Psychological Test, Kinds (Types) of Test, Intelligence Tests,

Abnormal Behavior – Definition, Classification of deviances, factors responsible for abnormal behavior, Main psychological abnormalities, Behavioral and Personal abnormalities,

Environment and Behavior – Introduction, relation between individual and environment, environmental stress and its effect, crowd, natural calamities,

Statistics – Definition and types of statistics, Descriptive statistics, standard of measurement, Standard deviation and concept of co-relation