For LA-01 to LA-05 for relevant subjects: Total Syllabus of Xth standard

For LA-01 to LA-05 for relevant subjects: Total Syllabus of Xth standard

FoodScience&Technology

I. Foodchemistry:

Carbohydrates, amino acids and proteins, Lipids, Vitamins and minerals classification,sources,functions,deficiencies,nutritionalsignificance,digestion,absorptionandmetabolism.Enzymesanditsclassificationandaction; Waterandelectrolytebalance.

II. FoodScience&QualityControl:

Cereals&Millets,Pulses&Legumes,milk&milkproducts,Egg&Fleshyfoods,Vegetables& Fruits, Sugar & Sugar products, Fats & oils – composition, nutritive value, methods ofprocessing, nutrient losses, uses & storage, anti-nutritional factors. Food adulteration, foodlawsandfoodsafety, food packaging, food labeling.

III. FoodMicrobiology

Introduction to microbiology and its relevance to everyday life-General morphology of micro-organisms– General characteristicsof bacteria, fungi, virus, protozoa, algae. Microbiologyof foods-cereals based products, meat, poultry, eggs, fruits, vegetables, milk, milk products,salts sugars etc. Role of microorganisms in fermented foods-bread, malt beverages, wine,vinegar, butter and cheese etc. Food poisoning and their causative organisms, food borneinfections.

IV. FoodProcessingandPreservation;

General principles of food processing ,preservation by high and low temperature, dryingirradiation,sugar,saltetc.Preparationofjams,jellies,marmalades,juices,squashes,ketchup,picklesandchutneys.Preparationofmilkproducts-cheesecondensedandevaporatedmilk,wholeandskimmilkpowderandicecream.

V. Nutrition:

Balanceddiet,RDA,Foodgroups,FoodPyramid,Foodexchangelist,Nutritionalrequirements for different age groups. Disorders of malnutrition, GIT disorders, Obesity,hypertension, renal diseases, cardiovascular diseases, Diabetes, Cancer & Inborn errors ofmetabolism– Etiology,symptomsanddietarymanagement, functional food and nutraceutical

vi.Community Nutrition and Public Health Education:

- Modes of Communication in Health Education
- School Health Services
- Principles of Community Nutrition
- Methods of Nutritional Assessment
- Epidemiology of Communicable Diseases
- Measures to Combat Malnutrition & Vital Statistics
- Health Administration
- Occupational Hazards
- Nutrition Intervention Programs

vii. Human Physiology:

- Cell-Structure and function
- Blood – Blood cells, Haemoglobin, Blood groups, Coagulation factors
- Skeletal Systems-Bones, joints & bone deformities in brief
- Cardiovascular system-Heart rate, Cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse
- Lymphatic system-Lymph glands and their function
- Spleen-structure and functions
- Respiratory System-Ventilation, functions, lung volume and capacity
- Gastrointestinal system-Process of digestion in various parts
- Endocrine glands
- Hormones-secretion and functions
- Excretion system- Structure of nephron, Urine formation
- Central Nervous System, Motor Nervous System, Sensory Nervous system, Sympathetic Nervous system & Parasympathetic nervous system
- Skin – Structure and functions
- Reproductive system – Structure and functions of male & female reproductive organs, menstruation puberty, menopause, fertilization and development of the fertilized ovum, placenta and its function
- Special senses- Structure and function of eye and ear, common diseases of eye and ear

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Bio Technology (BT)

- **Microbiology:** Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses.

- **Biochemistry:** Biomolecules and their conformation; Weak inter-molecular interactions in biomacro molecules; Chemical and functional nature of enzymes; Kinetics of single substrate and bi-substrate enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps; Cell cycle and cell growth control; Cell signaling and signal transduction;

- **Molecular Biology and Genetics:** Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.

- **Process Biotechnology:** Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exopolysacharides, antibiotics and pigments etc.; Microbial production, purification and bioprocess application(s) of industrial enzymes; Production and purification of recombinant proteins on a large scale; Chromatographic and membrane based bioseparation methods; Immobilization of enzymes and cells and their application for bioconversion processes. Aerobic and anaerobic biological processes for stabilization of solid / liquid wastes; Bioremediation.

- **Bioprocess Engineering:** Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed-batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale-up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

- **Plant and Animal Biotechnology:** Special features and organization of plant cells; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathways and products; Autotrophic and heterotrophic growth; Plant growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root cultures and their cultivation. Techniques in raising transgencies.

- **Characteristics of animal cells:** Metabolism, regulation and nutritional requirements for mass cultivation of animal cell cultures; Kinetics of cell growth and product formation and effect of shear force; Product and substrate transport; Micro & macro-carrier culture; Hybridoma technology; Livestock improvement; Cloning in animals; Genetic engineering in animal cell culture; Animal cell preservation.

- **Immunology:** The origin of immunology; Inherent immunity; Humoral and cell mediated immunity; Primary and secondary lymphoid organ; Antigen; B and T cells and Macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Synthesis of antibody and secretion; Molecular basis of antibody diversity; Polyclonal and monoclonal antibody; Complement; Antigen-antibody reaction; Regulation of immune response; Immune tolerance; Hyper sensitivity; Autoimmunity; Graft versus host reaction.

- **Recombinant DNA Technology:** Restriction and modification enzymes; Vectors: plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; cDNA and genomic DNA library; Gene isolation; Gene cloning; Expression of cloned gene; Transposons and gene targeting; DNA labeling; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In-situ hybridization; RAPD; RFLP; Site directed mutagenesis; Gene transfer technologies; Gene therapy.

- **Bioinformatics:** Major Bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases; Sequence analysis (bimolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA micro arrays and protein arrays); Molecular modeling and simulations (basic concepts including concept of force fields).

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BIOCHEMISTRY/ENVIRONMENTAL SCIENCE/FORENSIC SCIENCE / FERMENTATION TECHNOLOGY/GENETICS/MICROBIOLOGY (BCESFSFTG&M)

BCESFSG&M

Coordination Compounds, Applications of Coordination Compounds, Organo metallic Chemistry, Metal Carbonyls and Related Compounds, Bioinorganic Chemistry, Hard and Soft Acids and Bases (HSAB). Carboxylic Acids and Derivatives, synthesis Based on Carbanions, Nitro Hydrocarbons, Amines, Cyanides and Isocyanides, Heterocyclic Compounds, Carbohydrates, Amino Acids and Proteins, Electrochemistry and Emf, Chemical Kinetics, Thermodynamics. Photochemistry.

P-Block Elements, Chemistry of Zero Group Elements, Chemistry of d-Block Elements, Chemistry of f-Block Elements, General Principles of Inorganic Qualitative Analysis, Chemical Bonding, Molecular Orbital Theory, Theory of Quantitative Analysis, Theories of Bonding in Metals. Structural Theory in Organic Chemistry, Acyclic Hydrocarbons, alicyclic Hydrocarbons, aromatic Hydrocarbons, Halogen Compounds, Alcohols, Phenols, Ethers and Epoxides, Carbonyl Compounds, Conformational Analysis, Stereochemistry of Carbon Compounds. Atomic Structure and Elementary Quantum Mechanics, Gaseous State, Liquid State, Solutions, Dilute Solutions and Colligative Properties, Solid State Chemistry, Phase Rule, Colloids and Surface Chemistry, adsorption, Evaluation of Analytical Data.

BOTANY

Microbial Diversity:

Bacteria: Structure, Nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice. Brief account of Archaebacteria, Actinomycetes. General account of Mycoplasma with reference to Little leaf of brinjal and Papaya leaf curl.
Viruses: Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.

Algae

Algae: General characters, structure, reproduction and classification of algae (Fritsch**).**

Cyanobacteria: General characters, cell structure, thallus organisation and their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.

Structure and reproduction of the following:

Chlorphyceae-*Volvox, Oedogonium,*

Chara.Phaeophyceae-*Ectocarpus*.

Rhodophyceae-*Polysiphonia*.

Fungi: General characters and classification of fungi (Ainsworth). Structure and reproduction of thefollowing:

Mastigomycotina-

Albugo Zygomycotina-

Mucor

Ascomycotina-*Saccharomyces,*

*Penicillium*Basidiomycotina- *Puccinia*

Deuteromucotina-*Cercospora.*

Lichens: Structure and reproduction; ecological and economic importance.

Bryophytes, Pteridophytes, Gymnosperms and Paleobotany:

Bryophytes: Structure, reproduction, life cycle and systematic position of *Marchantia, Anthoceros and Polytrichum*. Evolution of Sporophyte in Bryophytes. **Pteridophytes**: Structure, reproduction, life cycle and systematic position of *Rhynia, Lycopodium, Equisetum* and *Marsilea*. Stelar evolution, heterospory and seed habit in Pteridophytes. **Gymnosperms**: General characters, structure, reproduction and classification (Sporne's). Distribution and economic importance of Gymnosperms. Morphology of vegetative and reproductive parts, systematic position and life cycle of *Pinus* and *Gnetum*.

Palaeobotany: Introduction, Fossils, types of fossils and fossilization, Importance of fossils. Geological time scale.

Taxonomy of Angiosperms:

Principles of plant systematic, Types of classification: Artificial, Natural and Phylogenetic; Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantle. An introduction to Angiosperm Phylogeny Group (APG).

Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy. Nomenclature and Taxonomic resources: An introduction to ICN, Shenzencode - a brief account. Herbarium: Concept, techniques and applications. Systematic study and economic importance of plants belonging to the families; Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, sclepiadaceae, Lamiaceae, Amaranthaceae,Euphorbiaceae, Monocotyledons: Orchidaceae and Poaceae, Zinziberaceae.

Ecology:

Component of eco system, energy flow, food chain and food webs. Plants and environment, ecological adaptations of plants, Hydrophytes, Xerophytes and Mesophytes. Plant Succession serial stages, modification of environment, climax formation with reference to Hydrosere and Xerosere. General account of adaptations in xerophytes and hydrophytes.

Plant Anatomy:

Meristems: Types, histological organization of shoot and root apices and theories. Tissues and Tissue Systems: Simple, complex and special tissues. Leaf: Ontogeny, diversity of internal structure; stomata and epidermal outgrowths. Stem and root anatomy: Vascular cambium - Formation and function. Anomalous secondary growth of Stem - *Achyranthes, Boerhaavia, Bignonia, Dracaena*; Root– *Beta vulgaris*. Wood structure: General account. Study of local timbers – Teak, Rosewood, Red sanders, Nallamaddi and Neem.

Embryology:

History and importance of Embryology. Anther structure, Microsporogenesis and development of male gametophyte. Ovule structure and types; Megasporogenesis; types and development of female gametophyte. Pollen morphology, pollination and fertilization, Pollination – Types, Pollen - pistil interaction, double fertilization. Seed structure appendages and dispersal mechanisms. Endosperm - Development and types. Embryo - development and type, Polyembryony and Apomixis - an outline.

Cell Biology

Plant cell envelops: Ultra structure of cell wall, Models of membrane structure, structure and functions of Semi permeable Plasma membrane. **Cell Organelles**: Structure and semiautonomous nature of Mitochondria and Chloroplast. **Nucleus:** Ultra structure, types and functions of DNA & RNA. Mitochondrial DNA & Plastid DNA and Plasmids. Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes. **Cell division**: Cell and its regulation; mitosis, meiosis and their significance

Genetics

Mendelism: History, Principles of inheritance, Chromosome theory of inheritance, Autosomes and sex chromosomes, Incomplete dominance and Co-dominance. Multiple alleles, Lethal alleles, Epistasis, Recessive and Dominant traits, Polygenic inheritance. Linkage and crossing over, Recombination frequency, two factor and three factor crosses; Interference and coincidence. Numericals based on gene mapping; Sex Linkage.Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy. Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens-physical and chemical (Base analogs, deaminating, alkylating and intercalating agents).

Plant Physiology

Plant -water Relations: Water potential, osmosis, osmotic and pressure potential, absorption and transport of water. **Mineral Nutrition**: Essential micro & macro nutrients and symptoms of mineral deficiency. **Transpiration**: Stomatal structure and movement. Mechanism of phloem transport. Enzymes: Nomenclature, properties, Classification and factors regulating enzyme activity.

Photosynthesis: Photosynthetic pigments, Cyclic and Non-cyclic Photophosphorylation. Carbon assimilation pathways: C3, C4 and CAM**. Respiration**: Aerobic and Anaerobic; Glycolysis, Krebs cycle and oxidative phosphorylation. **Nitrogen Metabolism**: Biological nitrogen fixation. Physiological role of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids.

SECTION – III: ZOOLOGY

Physiology and Biochemistry:

Digestion Digestion definition and extra and intracellular digestion. Digestion of Carbohydrates, Proteins, Lipids and Cellulose. Absorption and Assimilation of digested food; role of Gastrointestinal hormones in digestion **Respiration** Definition of Respiration and Respiratory mechanisms-External, Internal and cellular. Respiratory Pigments; Transport of oxygen, Oxygen dissociation curves. Bohr's effect. Transport of CO_2 – Chloride shift; Regulation of respiration – nervous and chemical **Circulation** Types of circulation - Open and Closed circulation Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic; Heart function -Conduction and regulation of heart beat. Regulation of Heart rate – Tachycardia and Bradycardia; Blood Clotting mechanism. **Excretion** Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic, Structure and function of Nephron. Urine formation, Counter current mechanism.

Physiology

Muscle Contraction: Types of Muscles, Ultra structure of skeletal muscle fibre, Sliding Filament theory, muscle contraction mechanism and energetics. **Nerve Impulse** Structure of Neuron, Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse, Synapse, types of synapses and Synaptic transmission. **Endocrine System** Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas, Hormone action and concept of Secondary messengers, Male and Female Hormones, Hormonal control of Menstrual cyclein humans.

Physiology and Biochemistry:

Homeostasis and Enzymes Concept of Homeostasis. Mechanism of Homeostasis. Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals, Enzymes: Definition, Classification, Inhibition and Regulation. **Biomolecules and Metabolism** Carbohydrates**:** Classification and function of Carbohydrates, Carbohydrate metabolism - Glycolysis, Krebs cycle, Electron transport and oxidative phosphorylation. Proteins**:** Classification of proteins based on functions and Chemical nature, Protein Metabolism - Transamination, Deamination and Urea Cycle, Lipids**:** Classification of Lipids, Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.

Immunology and Animal Biotechnology:

Immunology – Basic concepts; antigens and antibodies Basic concepts of immunology. Cells of immune system, Primary and secondary Organs of immune system, Types of Immunity – Innate and acquired, Basic properties of antigens, Structure, function and types of an antibody. B and T cell epitopes, haptens, adjuvants. Antigen-antibody reactions, T-Cell and B-Cell activation, Monoclonal antibodies and their production. **Working of an Immune system; Immune system in health and disease** Structure and functions of major histocompatibility complex. Basic properties and functions of Cytokines, Interferons and complement proteins,

Humoral and Cell mediated immunity. Types of hyper sensitivity. Concepts of autoimmunity and immunodeficiency. Introduction to Vaccines and types of Vaccines. **Animal Biotechnology and Genetically modified organisms** Concept and Scope of Animal Biotechnology. Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage, YAC Cloning- Cloning methods (Cell, Animal and Gene cloning) Animal Cell culture **-** Equipment and materials for animal cell culture; applications of cell culture techniques Recombinant DNA technology and its applications, Transgenesis – Methods of Transgenesis. Production of Transgenic animals and Application of Transgenic animals in Biotechnology. Stem cells –types and their applications.

Animal Diversity – Invertebrates

Brief history of Invertebrates: Kingdom Animalia, Brief history of Invertebrates. **Protozoa** General characters Classification up to classes with examples, Type study – *Elphidium,* Life cycle of *Plasmodium.* Locomotion, Reproduction and Diseases. **Porifera** General characters, Classification of Porifera up to classes with examples, Type study – *Sycon,* Canal system in sponges and Spicules. **Cnidaria** General characters, Classification of Cnidaria up to classes with examples, Type study – *Obelia,* Polymorphism in hydrozoa, Corals and coral reef formation. **Platyhelminthes** General characters Classification of Platyhelminthes up to classes with examples, Type study-*Schistosoma.* **Nemathelminthes** General characters Classification of Nemathelminthes up to classes with examples Type study-*Dracunculus,* Parasitic Adaptations in Helminthes.

Annelida: General characters, Classification of Annelida up to classes with examples Type study - *Hirudinaria granulosa.* Evolutionary significance of Coelome and Coelomoducts and metamerism. **Arthropoda** General characters, Classification of Arthropoda up to classes with examples, Type study – Prawn, Crustacean larvae, Insect metamorphosis, *Peripatus* - Structure and affinities. **Mollusca** General characters, Classification of Mollusca up to classes with examples, Type study – *Pila*, Pearl formation, Torsion and detorsion in gastropods. **Echinodermata** General characters, Classification of Echinodermata up to classes with examples, Water vascular system in star fish, Echinoderm larvae and their significance. **Hemichordata** General characters, Classification of Hemichordata up to classeswith examples, *Balanoglossus* - Structure and affinities.

Ecology, Zoogeography and Animal Behavior:

Ecology-I: Ecosystem structure and functions. Types of Ecosystems –Aquatic and Terrestrial. Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water. Energy flow in ecosystem. Food chain, food web and ecological pyramids. Animal Associations - Mutualism, commensalism, parasitism, competition, predation.

Ecology – II: Concept of Species, Population dynamics and Growth curves. Community Structure and dynamics and Ecological Succession. Ecological Adaptations. Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise Pollution. Wildlife conservation - National parks and Sanctuaries of India, Endangered species. Biodiversity and hotspots of Biodiversity in India.

Zoogeography: Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities, Wallace line, Discontinuous distribution Continental Drift.

Animal Behaviour: Types of Behaviour- Innate and Acquired, Instinctive and Motivated behavior, Taxes, Reflexes, Tropisms, Biological rhythms and types of rhythms, trial and error learning, Imprinting, habituation, Classical conditioning, Instrumental conditioning, Social behavior, Communication, Pheromones, Biological rhythms, Biological clocks, Circadian rhythms.

Animal Diversity- Vertebrates and Developmental Biology:

Urochordata, Cephalochordata, Cyclostomata: Salient features of Urochordata, Retrogressive, metamorphosis and its significance in Urochordata, Salient features and affinities of Cephalochordata General characters of Cyclostomata, Comparison of the *Petromyzon* and *Myxine,* General characters and classification of Chordata upto orders with examples. **Pisces** General characters of Fishes, Classification of fishes up to order level with examples, *Scoliodon* – Respiratory, Circulatory and Nervous system. Types of Scales and types of Fins

Amphibia: General characters of Amphibians, Classification of Amphibians up to orders with examples. *Rana tigrina*-Respiratory, Circulatory and Nervous system. Parental care in amphibian; neoteny and paedogenesis.

Reptilia: General characters of Reptilia, Classification of Reptilia up to orders with examples, *Calotes* - Respiratory system, Circulatory and Nervous system. Temporal fossae in reptiles and its evolutionary importance, Distinguished characters of Poisonous and Non poisonous snakes. Rhynchocephalia. **Aves** General characters of Aves, Classification of Aves up to orders with examples. *Columba livia* -, Digestive system, Circulatory systems, Respiratory system and Nervous, system. Migration in Birds, Flight adaptation in Birds, **Mammalia** General characters of Mammalia, Classification of Mammalia up to orders with examples Rabbit –Digestive, Respiratory, Circulatory and Nervous system. Dentition in mammals. Aquatic adaptations in Mammals. **Developmental Biology and Embryology** Gametogenesis (Spermatogenesis and Oogenesis) Fertilization, Types of eggs, Types of cleavages, Development of Frog up to formation of primary germ layers Formation of Foetal membrane in chick embryo and their functions, Types and functions of Placenta in mammals, Regeneration in Turbellaria and Lizards.

Cell Biology, Genetics & Evolution:

1. **Cell Biology** Ultrastructure of animal cell, Structure and functions of plasma membrane proteins. Structure and functions of cell organelles –Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus Chromosomes – Structure, types, giant chromosomes, Cell Division - Mitosis, Meiosis.

2. **Molecular Biology** DNA (Deoxyribo Nucleic Acid) – Structure, RNA (Ribo Nucleic Acid) - Structure, types, DNA Replication, Protein Synthesis – Transcription and Translation, Gene Expression – Genetic Code; operon concept, Molecular Biology Techniques- Polymerase Chain Reaction, Electrophoresis

3. **Genetics** Mendals laws of Inheritance and Non-Medelian Inheritance, Linkage and Crossing over, Sex determination and sex-linked inheritance, Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations- Induced versus Spontaneous mutations. Inborn errors of metabolism.

4. **Evolution** Theories of evolution – Lamarckism and Neo-Lamarckism, Darwinism and Neo- Darwinism, Modern synthetic theory. Evidences of Evolution and Hardy Weinberg Law. Forces of Evolution – mutation, gene flow, genetic drift, and natural selection. Isolation – Pre- mating and post mating isolating mechanisms, Speciation: Methods of speciation-Allopatric and sympatric.

SECTION – IV:
BIOCHEMISTRY

Elementary aspects of cell structure–function, tissues and body fluids. 2. Chemistry, physiological role and metabolism of biomolecules like carbohydrates, amino-acids, proteins, Lipids & nucleic acids. 3. Basic aspects of nutrition, endocrinology & Physiology, clinical biochemistry, enzymology, biological oxidations, photosynthesis. 4. Physiological role of vitamins and minerals. 5. Basic aspects of immunology. 6. Replication, transcription and protein synthesis. 7. Fundamental aspects of microbiology. 8. Elementary aspects of r-DNA technology and genetic engineering. 9. Principles, methodology and applications of various biochemical techniques used in biochemistry.

SECTION – V: GENETICS

CLASSICAL GENETICS

Mendelian Inheritance & extensions: Terminology and definitions –phenotypes, genotype, locus, allele, homozygotes, heterozygotes, Johanssen's pure line concept, filial generations, reciprocal cross, back cross, test cross; Law of segregation- Law of Independent Assortment, Extension to mendelian segregation patterns: Co-dominance, Incomplete dominance, Lethals, gene interaction- Epistasis- paramutation-Environmental effects on gene expression-Penetrance-Expressivity, Multiple alleles, and Pseudoalleles**;** Features of Quantitative Inheritance, Multifactorial inheritance, Extrachromosomal inheritance, Sex linked inheritance: X—linked and Y-linked traits, Sex chromosome inactivation –dosage compensation, Gynandromorph; **Linkage and gene mapping:** Cytological proof of crossing over, Phases of linkage, test cross, recombination

frequency, gene mapping, determination of map distances based on two and three point test crosses, coincidence, interference, Tetrad analysis –Neurospora, Mitotic crossing over-Drosophila**;** **Organellar inheritance:** Non-Mendelian inheritance, Chloroplast and Mitochondrial inheritance, Chloroplast and Mitochondrial genomes

CYTOGENETICS

Eukaryotic Cell cycle -Phases of cell cycle G0, G1,S, G2, Genes that determine the cell cycle – cyclins, CDK proteins, role of p53 in cell cycle, Mitosis –stages, significance of mitosis, Meiosis I & II- Stages, formation of synaptonemal complex, crossing over, chiasma formation, significance of meiosis**; Chromosome structure, chromatin organization and variation:** Chromosome morphology- size and shape; Euchromatin and Heterochromatin-constitutive and facultative heterochromatin, Components of chromatin, histones & non-histones, Packing of DNA into chromatin –Nucleosome and higher order organization, Specialized Chromosomes – Lampbrush chromosomes, Polytene Chromosomes, Super numerary chromosomes, Chromosome Variation- Structural and Numerical aberrations; **Cell communication and signaling:** Basics of cell signaling – paracrine, endocrine, autocrine, tight junctions and gap junctions, Secondary messengers - cAMP, phosphotidyl inositol, Ca^{+2} and IP3, G-protein coupled receptors and Tyrosine Kinase receptors**; Dysregulation of Cell cycle:** Necrosis, senescence, programmed cell death (apoptosis-intrinsic and extrinsic factors), Cancer

MOLECULAR GENETICS
Nucleic acids: DNA as the genetic material and experimental evidences, RNA as genetic material, Chemistry of Nucleic acids, Forms of DNA and types of RNA, Models and methods of DNA replication, Mechanism of DNA replication and enzymes involved**; Gene expression and regulation in prokaryotes and eukaryotes:** Structure of prokaryotic and eukaryotic gene, Transcription and Translation mechanisms, Genetic code and properties, Operon concept- lac operon & glucose effect, tryptophan operon, Post-transcriptional and Post-translational modifications in eukaryotes**; Mutations and repair mechanisms:** Mutations-spontaneous and induced mutations, Types of mutations, DNA damage & repair mechanisms, Diseases caused due to mutation-sickle cell anaemia and cystic fibrosis

MICROBIAL GENETICS & GENETIC ENGINEERING

Bacterial recombination and mapping: Bacteria- structure, Transformation and gene mapping, Conjugation and gene mapping High frequency recombination, interrupted mating experiment; **Genetics of bacteriophages:** Structure and classification of bacteriophages, Lytic cycle, Lysogeny, Generalized and specialized transductions**;** Enzymes used in molecular cloning, Vectors used in cloning, Genomic and cDNA libraries, Blotting techniques and PCR, Screening for detection of cloned genes, **Applications of genetic engineering-** Gene products in medicine, DNA based vaccines, Subunit vaccines, Attenuated vaccines, genetically engineered microorganisms for bioremediation, phytoremediation, Transgenic plants, Transgenic animals, Molecular pharming, Industrial products

BIOSTATISTICS & BIOINFORMATICS
Measures of central tendency and measures of dispersion, Grouped data and graphical methods, Probability, Binomial, Poisson and Normal distributions, t-test, z-test, chi-square test**;** Computer and Internet Basics, Biological databases, DNA Sequence and Protein sequence databases, Sequence retrieval from Genbank, ENA, Swissprot

POPULATION GENETICS & EVOLUTION
Allele frequencies and genotype frequencies at a locus, Hardy-Weinberg Law, Linkage disequilibrium, Snyder's ratios; Selection–fitness, patterns of natural selection, general selection equation, equilibrium under selection, Selection favoring heterozygote, selection against heterozygote, complete elimination of recessive gene; Mutation–mutation models, influence of mutation on allele frequency & autozygosity, balance between forward & backward mutation, interaction of mutation with selection; Genetic load, Gene flow, Wahlund effect, Inbreeding, construction of pedigrees inbreeding coefficient and inbreeding depression; Genetic Drift -Bottle neck effect, Founder effect, effective population size, consequences of a decreasing population size; Origins of genomes - Acquisition of new genes by gene duplication and from other species, Origin of non- coding DNA, transposable elements and introns, Molecular phylogenetics, Molecular Evolution, Molecular clock

SECTION – VI:
MICROBIOLOGY

Scope and importance of Microbiology, Spontaneous generation-biogenesis theory; Germ theory of diseases; Recent developments of Microbiology, Principles of microscopy, Principles of staining, Culture media, Sterilization methods, Isolation of pure cultures, maintenance and preservation of microbial cultures. Morphology and ultra-structure of typical eubacterial cell. Bacterial classification, General characteristics and classification of virus. Morphology and structure of T4, lambda phages; TMV and HIV. Nutritional types of bacteria, Bacterial growth, Respiration, Fermentation.

Biomolecules: Carbohydrates, amino acids, proteins, Biochemical techniques. DNA and RNA structures and their role as genetic materials, Transcription and translation, Lac operon, Bacterial plasmids and transposons, DNA damage and repair mechanisms, Mutations, Gene transfer mechanisms in bacteria, Recombinant DNA technology: methodology and application. Types of immunity, Organs of immune system, Cells of immune system, Antigens, Antibodies, Antigen- antibody reactions. Normal flora of human body. Infection, Disease, Defense mechanisms. Bacterial toxins, virulence and attenuation. Airborne diseases; Food and water borne diseases. General principles of diagnostic microbiology. Elements of chemotherapy-therapeutic drugs, Drug resistance. Concept of Biodiversity. Microbial diversity. Microorganisms of the environment (soil, water and air). Microbial interactions. Microorganisms in relation to plant growth and biological control, Biological nitrogen fixation, Biofertilizers. Biopesticides, Bioremediation. Microbiology of potable and polluted water. Microorganisms of food spoilage and their sources. Methods of food preservation. Microorganisms as food – SCP, edible mushrooms. Fermented foods. Screening and isolation of industrially useful microorganisms, strain improvement strategies and immobilization methods. Fermentor. Types of fermentations. Industrial production of Alcohol, Glutamic acid, Citric acid, vitamin B12, Enzymes, Antibiotics and Vaccines. Basics of Bioinformatics and computational tools in microbial sciences; Genomics, Proteomics and Metabolomics.

CHEMISTRY

Coordination Compounds, Applications of Coordination Compounds, Organo metallic Chemistry, Metal Carbonylsand Related Compounds, Bioinorganic Chemistry, Hardand Soft Acids and Bases (HSAB). Carboxylic Acidsand Derivatives, synthesis Basedon Carbanions, Nitro Hydrocarbons, Amines, Cyanidesand Isocyanides, Heterocyclic Compounds, Carbohydrates, Amino Acids and Proteins, Electrochemistryand Emf, Chemical Kinetics, Thermodynamics. Photochemistry. P-Block Elements, Chemistry of Zero Group Elements, Chemistry of d-Block Elements, Chemistry off- Block Elements, General Principles of Inorganic Qualitative Analysis, Chemical Bonding, Molecular Orbital Theory, Theory of Quantitative Analysis, Theories of Bonding in Metals. Structural Theory in Organic Chemistry, Acyclic Hydrocarbons, alicyclic Hydrocarbons,

aromatic Hydrocarbons, Halogen Compounds, Alcohols, Phen ols, Ethersand Epoxides, Carbonyl Compounds, Conformational Analysis, Stereoche mistry of Carbon Compounds. Atomic Structure and Elementary Quantum Mechanics, Gaseous State, Liquid State, Solutions, Dilute Solutions and Colligative Properties, Solid State Chemistry, Phase Rule, Colloids and Surface Chemistry, adsorption, Evaluation of Analytical Data.

Chemical Food Management Lab safety (Chemical hazard), first aid for various spillages.

ELECTRONICS

Digital Electronics:
1. Introduction to number systems, Logic gates OR, AND, NOT, XOR, NAND, NOR gates-Truth tables-Positive and negative logic-Logic families and their characteristics-RTL, DTL, ECL, TTL and CMOS.-Universal building blocks NAND and NOR gates. Laws of Boolean algebra De Morgan's Theorems-Boolean identities-Simplification of Boolean expressions-Karnaugh Maps- Sum of Products (SOP) and Product of sums (POS).

2. Combinational and Sequential Circuits: Multiplexer and De-Multiplexer-Decoder, Half adder, Full adder and Parallel adder circuits.   Flip flops-Rs, D, JK and JK Maser-Slave (working and truth tables) – Registers, Shift registers, Serial in Serial out, Serial in –parallel out, Parallel in-Serial out and Parallel in Parallel out registers, -Synchronous and asynchronous binary counters, Up/Down counters-Decade counter(7490)-working, truth tables and timing diagrams. Semiconductor memories-RAM, ROM, PROM, EPROM, EEPROM.

3. Digital Communication:
Fourier transforms, Properties of Fourier Transform, Sampling theorem, random signals and noise, correlation and power spectrum. Analog to digital converter, digital to analog converters, amplitude modulation, pulse width modulation. Pulse code modulation, pulse phase modulation, delta modulation, adaptive delta modulation, amplitude shift keying, frequency shift keying, phase shift keying, quadrature amplitude modulation. Parity check, Hamming distance, Hamming codes, cyclic codes, Manchester code, Walsh code, NRZ coding. Paging System, global positioning system, cellular telephone, Facsimile and videotext.

Circuit Analysis and Electronic Devices:
1. AC Fundamentals: The sine wave-Average and RMS values, the Operator J, Phasor diagram-Phasor representation of sinusoidal currents and voltages, Complex impedance and admittance, Polar and rectangular forms of complex numbers, Circuit analysis using complex number representation. **2. Passive networks:** Concept of voltage and current sources-Kirchoffs Voltage Law(KVL) and Kirchoff's Current Law (KCL)-Applications to simple networks consisting of resistors with AC and DC sources-Solution of networks using node and mesh analysis**. 3. Network theorems (DC and AC):** Superposition Theorem-Thevenin's Theorem-Norton's Theorem-Maximun power transfer Theorem-Milliman's Theorem-Reciprocity Theorem-Applications to simple networks. **4. Cathode Ray Oscilloscope:** Cathode Ray Tube (CRT) and its working, electron gun, focusing, deflection sensitivity, fluorescent screen. **5. RC an RL Circuits:** Transient response of RL and RC circuits with step input-time constants. Frequency response of RC and RL Circuits- Types of Filters: Low pass filter-High pass filter-Frequency response-Passive differentiating and integrating circuits. **6. Resonance:** Series resonance and parallel resonance RLC Circuits-Resonant Frequency- Q factor-Band width-Selectivity. **7. PN Junction:** Depletion region-Junction capacitance- Diode equation (no derivation) – Effect of temperature on reverse saturation current-V-I Characteristics and simple applications of (i)junction diode (ii) Zener diode (iii) Tunnel diode and (iv) Varactor diode. **8. Bipolar Junction Transistor (BJT):** PNP and NPN transistors-current components in BJT-BJT static characteristics(Input and Output)-Early effect-CB, CC, CE configurations (cutoff, active, and saturation regions) CE configuration as two port network-h-parameters-h-parameter equivalent circuit. Determination of h-parameters from the characteristics. Load line analysis. Transistor Biasing-Fixed and self bias. **9. Field Effect Transistor (FET):** Construction and working of JFET and MOSFET- output and transfer characteristics-Determination of FET Parameters. Application of FET as voltage variable resistor and MOSFET as a switch-Advantages of FET over BJT. **10.**

Uni Junction Transistor (UJT): Construction and working of UJT – Characteristics. Application of UJT as a relaxation oscillator. **11. Sillicon Controlled Rectifier (SCR):** Construction and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control. **12. Photo Electronic Devices:** Construction and characteristics of Light Dependent Resistor (LDR), Photo voltaic cell, Photo diode, Photo transistor and Light Emitting Diode (LED).

Analog Circuits and Communications:
1. Power Supplies: Rectifiers-Halfwave, fullwave and bridge rectifiers-Efficiency-Ripple factor-Regulation – Harmonic components in rectified output – Types of filters- Choke input (inductor) filter- Shunt capacitor filter-L section and π section filters- Block diagram of regulated power supply – Series and shunt regulated power supplies – Three terminal regulators (78XX and 79XX) – Principle and working of switch mode power supply (SMPS). **2. RC Coupled Amplifier:** Analysis and frequency response of single stage RC coupled CE amplifier. **3. Feedback:** Positive and negative feedback – Effect of feedback on gain, band width, noise, input and output impedances. **4. Operational Amplifiers:** Differential amplifier Block diagram of Op-Amp-Ideal characteristics of Op-Amp- Op- Amp parameters- Input resistance- Output resistance- Common mode rejection ratio (CMMR)-Slew rate- Offset voltages-Input bias current-Basic Op-Amp circuits- Inverting Op-Amp- Virtual ground-Non-inverting Op-Amp-Frequency response of Op-Amp. Interpretation of Op-Amp data Sheets. **5. Applications of Op-Amps:** Summing amplifier-subtractor- Voltage follower- Integrator-Differentiator – Comparator- Logarithmic amplifier- Sine wave [Wein Bridge] and square wave [Astable] generators- Triangular wave generator- Monostable multivibrator- Solving simple second order differential equation. Basic Op-Amp series regulator and shunt regulator – IC 555 Timer [Block diagram and its working] – IC 555 as monostable and astable multivibrators. **6. Communications:** Need for modulation-Types of modulation-Amplitude, Frequency and Phase modulation. Amplitude modulation-side bands-modulation index- square law diode modulator- Demodulation- diode detector. Frequency modulation working of simple frequency modulator- Ratio detection of FM waves- Advantages of frequency modulation. AM and FM radio receivers [block diagram approach].

Instrumentation Engineering

Electricity and Magnetism

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations

Electrical Circuits and Machines

Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductance and capacitor; transient analysis of RLC circuits with DC excitation

Kirchoff's laws, Mesh and Nodal analysis, Superposition, Thevenin's Norton's, maximum power transfer and reciprocity theorems.

Peak, Average and RMS values of AC quantities; apparent, active and reactive powers, Phasor analysis, Impedance and admittance, Series and parallel resonance, Locus diagrams, Realization of basic filters with R, L and C elements. transient analysis of RLC circuits with AC excitation.

One-port and two-port networks, driving point impedance and admittance, open-, and short circuit parameters.

Single phase transformer: Equivalent circuit, Phasor diagram, Open circuit and Short circuit tests, Regulation and efficiency; Three phase induction motors: Principle of operation, Types, performance, Torque-speed characteristics,No-load and blocked rotor tests, Equivalent circuit, Starting and speed control; Types of losses and efficiency calculations of electric machines.

Transducers, Mechanical Measurement and Industrial Instrumentation: Resistive, Capacitive, Inductive and Piezoelectric Transducers, Hall effect sensors and their Signal Conditioning. Measurement of Displacement, Velocity and Acceleration (Translational and Rotational), Force, Torque, Vibration and Shock. Measurement of Pressure, Flow, Temperature and Liquid Level. Measurement of Ph, Conductivity, Viscosity and Humidity.

Analog Electronics: Characteristics of Diode, BJT, JFET and MOSFET. Diode Circuits. Transistors at Low and High Frequencies, Amplifiers: Single and Multi-Stage, Feedback Amplifiers. Operational Amplifiers, Characteristics and Circuit Configurations. Instrumentation Amplifier. Precision Rectifier. V-To-I and I-To-V Converter. OP-Amp Based Active Filters. Oscillators and Signal Generators.

Digital Electronics: Combinational Logic Circuits, Minimization of Boolean Functions, IC Families, TTL, MOS and CMOS. Arithmetic Circuits. Comparators, Schmitt Trigger, Timers and Mono-Stable Multi- Vibrator, Sequential Circuits, Flip-Flops, Counters, Shift Registers. Multiplexer, S/H Circuit. Analog to-Digital and Digital- to-Analog Converters. Basics of Number System. Microprocessor Applications, Memory and Input-Output Interfacing, Microcontrollers.

Signals, Systems and Communications: Periodic and Aperiodic Signals, Impulse Response, Transfer Function and Frequency Response of First- and Second Order Systems, Fourier Transform, Laplace Transform, Sampling Theorem, Z-Transform, Convolution, Correlation and Characteristics of Linear Time Invariant Systems. Discrete Time System, Impulse and Frequency Response. Pulse Transfer Function, Ideal filters: LPF, HPF, BPF, BSF, Amplitude and Frequency Modulation and Demodulation. Pulse Code Modulation. Frequency and Time Division Multiplexing. Amplitude Shift Keying, Frequency Shift Keying and Phase Shift Keying for Digital Modulation.

Electrical and Electronic Measurements: Static and Dynamic Characteristics of Measurement Systems. Error and Uncertainty Analysis, Bridges and Potentiometers, Measurement of R, L and C. Measurements of Voltage, Current, Power, Power Factor and Energy. AC & DC Current Probes. Extension of Instrument Ranges. Q-Meter and Waveform Analyzer. Digital Voltmeter and Multi-Meter. Time, Phase and Frequency Measurements. Cathode Ray Oscilloscope. Serial and Parallel Communication. Shielding and Grounding.

Control Systems and Process Control: Feedback Principles. Signal Flow Graphs. Transient Response, Steady-State-Errors. Stability analysis using Routh and Nyquist Criteria. Bode Plot, Root Loci. Time DelaySystems. Phase and Gain Margin. State Space Representation of Systems. Mechanical, Hydraulic and Pneumatic System Components. Synchro Pair, Servo and Step Motors. on-off, Cascade, P, PI, PID, Feed Forward and Derivative Controller, Fuzzy Controllers.

Analytical, Optical and Biomedical Instrumentation: Mass Spectrometry. UV, Visible and IR Spectrometry. X-Ray and Nuclear Radiation Measurements. Optical Sources and Detectors, LED, Laser, Photo- Diode, Photo-Resistor and their Characteristics. Interferometers, Applications in Metrology. Basics of Fiber Optics. Biomedical Instruments, EEG, ECG and EMG. Ultrasonic Transducers and Ultrasonography. Principles of Computerized Tomography (CT) & Generations of CT.

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Principles of Sociology: Sociology: Its Definitions, Nature, Scope, Emergence, Importance, Methods and Its relationship with other Sciences – Major Theoretical Perspectives and Basic Orientation of Sociological Theories: Importance, Applications and Research Fields of Sociology-Society: Its Definitions, Nature, Characteristics, Functions and Its theories of Evolution-Typology of Sociology: Tribal, Agrarian/Peasant, Rural, Urban, Industrial and Post-Industrial-Society and Individual: Influence of Heredity and Environment on Personality Development.

Community – Association-Social Group: their Characteristics and Classification-Elements of Social Structure and Social System-Role, Status, Values, Norms-Culture: Definitions, Elements, Cultural Relativity, Cultural Lag, Acculturation, Enculturization, Ethnocentricism, Xenocentricism-Social Integration: Associative and Dissociative Social Processes-Socialization: Meaning. Types, Agencies and Significant Theories.

Social Institutions: Family, Marriage and Kinship-their Classification, Patterns and Usages; -Economy: Concept of Property, Economic systems of simple and complex societies, free market and planned economy- Polity: Power, Authority and Legitimacy, Civil Society, Political Socialization and Modernization, Pressure Groups.

Social Stratification and Mobility: Forms and Functions-Caste, Class, Gender and Estate-Theories of social stratification – Ethnicity and Diaspora-Social Control: Deviance and Conformity-Means and Agencies of Social Control – Social Change-Theories and Factors of Social Change.

Sociological Thought: Auguste Comte, Herbert Spencer, Karl Marx, Emile Durkheim and Max Weber.

Indian Society: Perspectives on the study of Indian society: Indological, Structural-Functional, Marxist, Civilizational and Subaltern – Ethnic Formation of Indian society: Indo-Aryans, Dravidians and Aboriginals-Hindu Social Order: Varmashramas, Pursharthas, of Adwaitha, Dwaitha, Visistaadwaitha – Emergence of Jainism and Buddhism; Their Social Base and Philosophies.

Advent of Islam: Sufism and Bhakti Movements – Colonial Period: Advent of British and Christianity – Emergence of Modern Structures and Classes, Education, Bureaucracy, Westernization, Modernization, Secularization – Agraian Social Structure & Unrest, Land Reforms – Revivalism in India: Sanskritization and Hindutva – Tenets, Rituals, Customs, Family, Marriage, Kinship among Hindus, Muslims and Christians.

Tribes in India: Geographical, Racial and Linguistic Distribution and Demography Indicators – Tribal Family: Structure, Composition and Typology-Tribal marriage: Ways of acquiring mate, types and Functions-Kinship: Terminology & Usages, Lineage, Clan, Phratry, Moiety-Difference between Tribal and Non-Tribal Culture – Cultural Contact and Allied Problems – Forms of Tribal Economy; Reciprocity, Redistribution and Exchange-Tribal Polity: Forms, Law and Justice – Tribal Religion; Forms, Functions – Relationship between Religion, Magic and Science.

Caste System in India: Characteristics, functions and Theories on its emergence – Jajmanj System – Caste Endogamy – Social Movements in India: Dissent, Protest, Reformation – Constitutional Provisions and Legal Safeguards for SC, ST, OBC/BC, Women, Persons with Disabilities (PWD) and their Welfare, Empowerment and Development-Social change in modern India: its factors and implications.

Social Problems in India: Casteism, Untouchability, Poverty, Unemployment, Child Labour, Alcoholism, Beggary, Crime, Juvenile Delinquency, Prostitution, Dowry, Violence against Women, marriage Breakdowns, Communal Tensions, Environmental Degradation, Rapid and Uneven Urbanization, Migration, Brain-drain and Corruption.

ANTHROPOLOGY
PAPER-I

1.1 Meaning, Scope and development of Anthropology.

1.2 Relationships with other disciplines : Social Sciences, behavioural Sciences, Life Sciences, Medical Sciences, Earth Sciences and Humanities.

1.3 Main branches of Anthropology, their scope and relevance :

   (a) Social-cultural Anthropology.

   (b) Biological Anthropology.

   (c) Archaeological Anthropology.

   (d) Linguistic Anthropology.

1.4 Human Evolution and emergence of Man :

   (a) Biological and Cultural factors in human evolution.

   (b) Theories of Organic Evolution (Pre-Darwinian, Darwinian and Post-Darwinian).

   (c) Synthetic theory of evolution; Brief outline of terms and concepts of evolutionary biology (Doll's rule, Cope's rule, Gause's rule, parallelism, convergence, adaptive radiation, and mosaic evolution).

1.5 Characteristics of Primates; Evolutionary Trend and Primate Taxonomy; Primate Adaptations; (Arboreal and Terrestrial) Primate Taxonomy; Primate Behaviour; Tertiary and Quaternary fossil primates; Living Major Primates; Comparative Anatomy of Man and Apes; Skeletal changes due to erect posture and its implications.

1.6 Phylogenetic status, characteristics and geographical distribution of the following :

   (a) Plio-preleistocene hominids in South and East Africa—Australopithecines.

   (b) *Homo erectus : Africa (Paranthropus),* Europe *(Homo erectus (heidelbergensis),* Asia *(Homo erectus javanicus, Homo erectus pekinensis.*

   (c) Neanderthal man—La-chapelle-aux-saints (Classical type), Mt. Carmel (Progressive type).

   (d) Rhodesian man.

   (e) *Homo saoiens*—Cromagnon, Grimaldi and Chancelede.

STATISTICS

Analysis of Quantitative Data:- Ordinal, Nominal and Interval scale data, Univariate data – Measures of central tendency (Mean, Median and Mode with simple applications), Measures of Dispersion (Variance, Standard deviation, IQR, Coefficient of variation, definitions and simple examples), relative Dispersion and their areas of application. Importance of Moments. Central and Non-central Moments, Sheppard's corrections for moments for grouped data. Skewness and Kurtosis-their measures including those based on quartiles and moments with real life examples. Probability and Random Experiment:-Definition of Probability, Classical and Relative frequency approach to Probability, merits and demerits of these approaches. Random experiment, sample point and sample space, definition of an event, operation of events. Properties of probability based on axiomatic approach, Addition theorem for 'n' events, conditional Probability, Multiplication rule of probability for 'n' events, Boole's inequality, Independence of events, Baye's theorem and its applications(with examples of real life).

Random Variables:-Notion of a Random variable, Distribution function and its properties. Discrete random variable, Probability Mass function, Continuous random variable, Probability Density function. Transformation of one dimensional random variable (simple1-1functions only).

Mathematical Expectation:-Mathematical expectation of random variable and its properties. Moments-Raw and Central moments with examples –Definition of Moment generating function (m.g.f), Cumulant generating function (c.g.f). Probability generating function (p.g.f) and Characteristic function, statements of their properties with applications. Chebychev's in equality and its applications. Statement and applications of Weak law of Large numbers and Central limit theorem for i.i.d. random variables with finite variance.

Discrete Distributions:-Standard discrete distributions and their properties such as m.g.f, c.g.f, p.g.f., Characteristic function, moments up to fourth order of Uniform, Binomial, Poisson, Negative Binomial, Geometric and Hyper-Geometric distributions. Reproductive property wherever it exists. Binomial approximation to Hyper-Geometric, Poisson approximation to Binomial and Negative Binomial Distributions. Applications of these distribution sin real life.

Continuous Distributions:-Normal distribution-Definition, properties and its importance in Statistics. Normal distribution as limiting case of Binomial and Poisson distributions. Definitions and properties such as m.g.f, c.g.f, Characteristic function, moments up to fourth order of Rectangular, Gamma, Beta first and second kind distributions. Exponential, and Cauchy distributions. Reproductive property wherever it exists. Application of these distributions in real life. Bivariate data. Scattered diagram. Principle of Least squares, fitting of Straight line, Quadratic, Power and Exponential curves. Product moment Correlation coefficient and its properties, Partial and Multiple Correlation coefficients (only for three variables). Spearman's Rank correlation coefficient. Simple linear regression, Correlation and regression-comparison, Coefficient of Determination, Correlation ratio. Bivariate random variable –discrete and continuous, joint, marginal and conditional distributions, distribution function of bivariate random variable, statement of its properties, simple illustrations. Mathematical expectation of bivariate random variable. Covariance, additive and multiplication theorems of mathematical expectation, correlation coefficient and lines of regression with illustrations. Concept of Population, Parameter, Random Sample, Statistic. Sampling distribution of the sum of observations from Binomial, Poisson and Normal distribution, Standard error. Exact Sampling Distributions–Statements and Properties of x^2, t and F distributions and interrelations.

Theory of Estimation:-Point Estimate of parameter, concept of bias and mean square error of an estimate. Criteria of good estimator-Consistency, Unbiasedness, Efficiency and Sufficiency, Statement of Nyman's Factorization theorem, derivations of Sufficient statistics in Binomial, Poisson, Normal and Exponential cases (one parameter only).Estimation by the Method of Moments and Maximum Likelihood Method. Statements of asymptotic properties of Maximum Likelihood Estimators. Concept of Interval estimation, Confidence intervals of parameters of Normal population.

Testing of Hypotheses:-Concepts of null hypothesis, alternative hypothesis, critical region, two types of errors, level of significance and power of a test. Neyman's – Pearson lemma for testing a simple null-hypothesis against a simple alternative and examples on the case of Binomial, Poisson, Exponential and Normal (for mean with known SD) distributions.

Analysis of Categorical Data:-Consistency of Categorical data. Independence and Association of Attributes, various measures of association for two-way data with real life examples. Chi-square and F distributions, Chi-Square test for goodness of fit, test for independence of attributes.

Parametric tests:-Use of central limit theorem for testing. Fisher's Z-transformation and its uses. One sample t test, Independent two sample t test, Paired t test, Single proportion, difference of two proportions. Comparison of Parametric and Nonparametric tests, their advantages and disadvantages.

Nonparametric tests:- One sample Run test. Sign test and Wilcoxon SignedRank tests for one sample and two related samples. Tests for two independent samples: Median test, Wilcoxon Mann-Whitney U-test, Wald-Wolfowitz Runs test.(Small and Large samples).

Designs of Experiments:-Analysis of variance of one way and two way classifications. Expectation of various sums of squares. Importance and applications of designs of experiments, principal of Experimentation. Analysis of completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD) including one missing observation, comparison of their efficiencies, expectation of various sums of squares.

Designs of Sample Surveys:-Random Numbers, drawing random samples, Sample surveys versus census surveys. Planning and execution of large scale sample surveys, notion of non-sampling errors, sources and treatment of non-sampling errors. Estimation of population mean, population total, population proportion and variance of the estimators by

i) Simple Random sampling with and without replacements.

ii) StratifiedRandomsamplingwithproportionalandNeyman'soptimumallocation.

iii) Systematic sampling. Comparison of their efficiencies.

iv) Cluster sampling

Time Series Analysis:-Components of Time Series, Determination of trend by graphical, semi-average, Least squares and moving average methods. Determination of Seasonal indices by Simple averages, Ratio to moving averages, Ratio to trend and Link relative methods.

Index Numbers:- Construction, uses and limitations of Index numbers. Simple and Weighted index numbers, consistency tests for an Index number, base shifting, splicing and deflation. Fixed and Chain base Index numbers. Cost of living Index numbers and Wholesale price Index numbers.

Demand Analysis:- Introduction, Demand and Supply, Price Elasticity's of Supply and Demand, Methods of determining Demand and Supply Curves: Time Series Data, Leontief's method of finding Demand Curve from time Series Data. Limitations of the method, Pigous's method from Time Series Data, Pareto's law of Income distribution, Curve of concentration.

Vital Statistics and Indian Official Statistics:-Rates, Proportions and ratios, Standardized rates, Fertility and Reproduction rates, Construction and uses of complete and abridged life tables. Functions and organization of CSO and NSSO. Agricultural statistics, Area and Yield statistics. National Income and its computation. Utilities and difficulties in estimation of National Income.

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Data Science

1. **FundamentalsofInformationTechnology:**DataandInformation,AcquisitionofNumbersandTextualData,CentralProcessingUnit,ComputerNetworks,InputOutputDevices,ComputerSoftware,TheSoftwareProblem.ProgrammingPrinciplesandGuidelines.

2. **ProblemSolvingandPythonProgramming:**IntroductiontoComputingandProblemSolving.IntroductiontoPythonProgramming.ControlFlowStatements.Functions.Strings.Filesandexception.Object-OrientedProgramming.FunctionalProgramming.

3. **DataEngineeringwithPython:**DataScience;FilesandWorkingwithTextData,Working with Text Data. Working with Text Data, Regular Expression Operations, Workingwith Databases, Working with Tabular Numeric Data (Numpy with Python),Working withDataSeriesand Frames,Plotting(Plotting withPandas).

4. **Machine Learning:**Introduction, Limits of Learning, Geometry and Nearest Neighbours,ThePerceptron,PracticalIssues,LinearModels,ProbabilisticModeling,NeuralNetworks,UnsupervisedLearning,AssociationRules.

5. **Natural Language Processing:** Language Processing and Python, Accessing Text Corporaand Lexical Resources, Processing Raw Text, Categorizing and Tagging Words,Learning toClassifyText,DeepLearningforNLP,ExtractingInformationfromText,AnalysingSentenceStructure.

6. **NoSQLDataBases:**WhyNoSQL,AggregateDataModels,MoreDetailsonDataModels,DistributionModels,Consistency,VersionStamps,Map-Reduce,Key-ValueDatabases,DocumentDatabases,Column-FamilyStores,GraphDatabases.

7. Big Data: Getting an overviewof Big Data,Introducing Technologiesfor Handling BigData,UnderstandingHadoopEcosystem,HadoopDistributedFileSystem,IntroducingHBase,UnderstandingMapReduceFundamentalsandHBase,UnderstandingBigDataTechnology Foundations,Storing Data in Databases and Data Warehouses,NoSQL DataManagement**.**

8. **Deep Learning:** Introduction to deep learning Algorithms, Neural Networks, Scalars (0Dtensors), Vectors (1D tensors), Matrices (2D tensors), 3D tensors and higher-dimensionaltensors, Key attributes, Manipulating tensors in Numpy, The notion of data batches, Real-world examples of data tensors, Vector data, Timeseries data or sequence data, Image data,Video data. Tensor operations: Element-wise operations, Broadcasting, Tensor dot. Tensorreshaping, Geometric interpretation of tensor operations, A geometric interpretation of deeplearning, Gradient-based optimization, Derivative of a tensor operation, Stochastic gradientdescent. Chaining derivatives: the Backpropagation algorithm Neural networks: Anatomy,Layers, Models, Loss functions and optimizers. Introduction to Keras, Keras, TensorFlow,Theano, andCNTK,Recurrent neuralnetworks: A recurrent layer in Keras,UnderstandingtheLSTMandGRU Layers.

CivilEngineering

Unit–I:ENGINEERINGMECHANICS

Forces and moments- Vectors and scalars, types of supports. Location ofcentroid of T, L, I, channel, Z sections. Built-up sections.

Unit-II:REINFORCEDCONCRETESTRUCTURES

Grades of concrete, characteristic strength, Modulus of Elasticity-I.S.456-2000- Philosophy ofLimit state design. Limit state of Strength and Serviceability, partial safety factor-design strengthofmaterials and design loads- assumptions.

Analysis and Limit state design of rectangular Beams-Singly, Doubly reinforced and T-beams.Shear in RCC beams - Development length. Slabs-analysis and limit state design of one-way andtwo-wayslabsasperIS.456-2000,Torsionreinforcement.Designofcontinuousslabsandbeams - Deflection check forslabs and beams.Detailing ofreinforcement insingly reinforced anddoubly reinforced simply supported beams of rectangular sections and lintels, one way and twowayslabs.

Columns: Codal provisions of I.S 456-2000 - short and long columns-different shapes-design ofshort columns by limit state method-long columns- concept, effective length for different endconditions.Footings-Isolated column footings-onewayshearand two wayshear.Stairs– types.

Unit-III: SURVEYING

Methods of calculation of area. Leveling -definitions - component parts of Dumpy level - errors - Methods of levelling - contouring -characteristics and methods. Civil Engineering, Curves-simple curves, elementsofsimplecurve, settingoutofsimplecurvesby chain & tape, single & double the odolitemethod.

Unit-IV: HYDRAULICS

Reciprocating and Centrifugal pumps (without problems).

Unit-V:IRRIGATION ENGINEERING

Cross drainage works – types and functions. Soil erosion, Types and causes-measures to control erosion.

Unit-VI: TRANSPORTATION ENGINEERING

Water bound macadam roads, Cement concrete roads.

Unit-VII: WATERSUPPLYANDSANITARYENGINEERING

Qualityofwater, Needforprotectedwatersupply, Totalquantityofwaterforatown, percapit demand and factors affecting demand, forecasting population by arithmetical, geometrical and incremental increase methods, Sources and conveyance of water: surface sources, underground sources, Types of Intakes. Quality and Method of purification of water.

Distribution System: Methods of supply, Storage-Distribution systems, Types of layout- deadend, grid, radial and ring system their merits and demerits and their suitability. General layout of water supply arrangements in buildings.

System of sewage disposal-types of sewerage systems, Different shapes of cross-section forsewers, Strengthofsewage, samplingofsewage, characteristicsofsewage-principlesoftreatment, Preliminary treatment, secondary treatment. Sewers –sewer appurtences-shapes, meritsanddemerits.

Unit-VIII:BUILDINGMATERIALSANDCONSTRUCTIONPRACTICE

Stones-classificationofrocks.Bricks–manufacturing,testsonbricks.Tiles- typesoftiles.Cement-classification manufacturing-tests. Mortars – classification - proportioning. Concrete-proportioning – water-cement ratio – workability – admixtures-curing methods-R.M.C. Timberandsurface protective materials. Characteristics-types and uses.

Classification of buildings, foundations-N.B.C. classification-bearing capacity of soil- types offoundations.Masonry-Bonds inbrickmasonry.Plastering-purpose. Pointingpurpose andtypes.

PHYSICS

Mechanics

1. **Vector Analysis:** Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field and related problems. Vector integration, line, surface and volume integrals. Stokes, Gauss and Greens theorems- simple applications

2. **Mechanics of Particles:** Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section,

3. **Mechanics of rigid bodies:** Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope,

4. **Central Forces:** Central forces–definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential land gravitational field, motion under inverse square law, derivation of Kepler's laws, Coriolis force and its expressions.

5. **Special theory of relativity:** Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four vector formalism.

Waves and Oscillations

1. **Fundamentals of vibrations:** Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, torsion pendulum,-measurements of rigidity modulus, compound pendulum, measurement of 'g', combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajous figures

2. **Damped and forced oscillations:** Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance(Coupled Oscillators).

3. **Vibrating Strings:** Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretch edstringclampeda tends, overtones, energy transport, transverse impedance

4. **Vibrations of bars:** Longitudinal vibrations in bars-wave equation and its general solution. Special cases

        (i) bar fixed at both ends

        ii) bar fixed at the midpoint

        iii) bar free at both ends

        iv) bar fixed at one end. Transverse vibrations in a bar-wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

Thermodynamics

1. **Kinetic theory of gases:** Introduction-Deduction of Maxwell'slaw of distribution of molecular speeds, Transport Phenomena-Viscosity of gases- 2 thermal conductivity-diffusion of gases.

2. **Thermodynamics:** Basics of thermo dynamics-Kelvin's and Clausius statements–Thermodynamic scale of temperature –Entropy, physical significance – Change in entropy in reversible and irreversible processes–Entropyanddisorder–Entropyofuniverse–Temperature-Entropy(T-S) diagram–Change of entropy of aperfect gas-change of entropywhenicechangesintosteam.

3. **Thermodynamic potentials and Maxwell's equations:** Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clapeyron's Equation-Derivation for ratio of specific heats– Derivation for difference of two specific heats for perfect gas.Joule-Kelvineffect–expressionforJoule-KelvincoefficientforperfectandVander Waal'sgas.

4. **Low temperature Physics:** Joule Kelvin effect–liquefaction of gasusingporousplug experiment. Joule expansion – Distinction between adiabatic and Joule Thomson expansion–Expression for Joule Thomson cooling–Lique   faction   of   helium,   Kapitza's   method–Adiabaticdemagnetization–Productionoflowtemperatures–Principleofrefrigeration, vapour compression type.

5. **Quantum theory of radiation**: Blackbody-Ferry's black body – distribution of energy in the spectrum of Black body – Wein's displacement law, Wein's law, Rayleigh-Jean's law –Quantum theory of radiation– Planck'slaw–deduction of Wein's distribution law, Rayleigh-Jeanslaw, Stefan's law from Planck's law. Measurement of radiation using pyrometers – Disappearing filament optical pyrometer – experimental determination – Angstrompyrhelio meter-determination of solar constant, effective temperature of sun.

6. **Statistical Mechanics:** Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles, classical and quantum statistics and their differences, concept

of probability, Maxwell-Boltzmann's distribution law -Molecular energies in an ideal gas- Maxwell-Boltzmann's velocity distribution law, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws, Application of B-E distribution to Photons-planks radiation formula, Application of Fermi-Dirac statistics to white dwarfs and Neutronstars.

OPTICS

1. **Interference:** Principle of super position–coherence–temporal coherence and spatial coherence–conditions for Interference of light

Interference by division of wave front: Fresnel's Biprism – determination of wavelength of light. Determination of thickness of a transparent material using Biprism – change of phase on reflection–Lloyd's mirror experiment.

Interferencebydivisionofamplitude:Obliqueincidenceofaplanewaveonathinfilmdueto reflected and transmitted light (Cosine law) – Colours of thin films – Non reflecting films – interference by a plane parallel film illuminated by a point source – Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film) – Determination of diameter of wire-Newton's ringsin reflected light with and without contact between lens and glass plate, Newton's rings in transmitted light (Haidinger Fringes) – Determination of wavelength of monochromatic light – Michelson Interferometer – types of fringes – Determination of wave length of monochromatic light, Difference in wave length of sodium D_1, D_2 lines and thickness of a thin transparent plate.

2. **Diffraction**: Introduction–Distinction between Fresnel and Fraunhofer diffraction

Fraunhofer diffraction: -Diffraction due to single slit and circular aperture–Limit of resolution

–Fraunhofer diffraction due to double slit–Fraunhofer diffraction pattern with N slits(diffraction grating) Resolving Power of grating–Determination of wave length of light in normal and oblique incidence methods using diffraction grating.

Fresnel diffraction-Fresnel'shalf period zones – area of the half period zones –zone plate – Comparison of zone plate with convexlens–Phasereversalzoneplate–diffraction at a straight edge–difference between interference and diffraction.

3**. Polarization**: Polarized light : Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption , scattering of light – Brewsters law – Malus law – Nicolprism polarizer and analyzer – Refraction of plane wave incident on negative and positive crystals (Huygen's explanation) – Quarter wave plate, Half wave plate –Babinet's compensator – Optical activity, analysis of light by Laurent's half shadepolarimeter.

4. **Aberrations and Fiber Optics:** Introduction– Monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration–the achromatic doublet–Removal of chromatic aberration of a separated doublet. Fiber Optics: Introduction–Optical fibers–Principles of fiber communication–Step and graded index fibers–Rays and modes in an optical fiber–Fibermaterial–Types of optical fibers and advantages of fiber communication.

Electromagnetism, Electrostatics:

Electric Field: - Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms),application to linear, plane and spherical charge distributions. Conservative nature of electric field E, irrotational field. Electric Potential: - Concept of electricpotential, relation between electric potential and electric field, potential energy of a system of charges. Energy density in an electric field. Calculation of potential from electric field for a spherical charge distribution.

Magnetostatics

Concept of magnetic field B and magnetic flux, Biot-Savart's law, B due to a straight current carrying conductor. Force on a point charge in a magnetic field. Properties of B, curland divergence of B, solenoidal field. Integral form of Ampere's law, applications of Ampere'slaw: Magnetic field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance. Magnetic force between two current carrying conductors. Magnetic field intensity.

Ballistic Galvanometer: - Torque on a current loop in a uniform magnetic field, working principle of Ballistic Galvanometer, current and charge sensitivity, electromagnetic damping, critical damping resistance.

Electromagnetic Induction

Faraday's laws of induction (differential and integral form), Lenz'slaw, self and mutual Induction. Continuity equation, modification of Ampere's law, displacement current, Max well equations.

Electromagnetic waves

Maxwell's equations in vacuum and dielectric medium, boundary conditions, plane wave equation: transverse nature of EM waves, velocity of light in vacuum and in medium, polarization, reflection and transmission. Polarization of electromagnetic waves, Brewster's angle, description of linear, circular and elliptical polarization.

MODERNPHYSICS

1. **Atomic Spectra and Models Inadequacy of classical physics:**

Brief Review of Black body Radiation, Photo electric effect, Compton effect, dual nature of radiation, wave nature of particles. Atomic spectra, Line spectra of hydrogen atom, Ritz Rydberg combination principle. Alpha Particle Scattering, Rutherford Scattering Formula, Rutherford Model of atom and its limitations, Bohr's model of H atom, explanation of atomic spectra, correction for finite mass of the nucleus, Bohr correspondence principle, limitations of Bohr model, discrete energy exchange by atom, Frank Hertz Experiment. Sommerfeld's modification of Bohr's Theory. Wave Particle Dualityde Broglie hypothesis, Experimental confirmation of matter wave, Davisson Germer Experiment, velocity of de Broglie wave, wave particle duality, Complementarity. Super position of two waves, phase velocity and group velocity, wave packets, Gaussian Wave Packet, spatial distribution of wave packet, Localization of wave packet in time.Time development of a wave Packet; Wave Particle Duality, Complementarity. Heisenberg Uncertainty Principle, Illustration of the Principle through Experiments of Gamma ray microscope and electron diffraction through a slit. Time independent and time dependent Schrodinger wave equation. Estimation of ground state energy of harmonic oscillator and hydrogen atom, non-existence of electron in the nucleus. Uncertainty and Complementarities.

2. **Nuclear Physics:** Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus. Fission and fusion-mass deficit, relativity and generation of energy; Fission-nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235;Fusion and thermo nuclear reactions driving stellar energy(brief qualitative discussions), Classification of Elementary Particles.

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Journalism and Mass communication

Fundamentals of Communication: Fundamentals of Communication; Meaning and features of communication; Techniques of communication: formal/ informal, verbal/written, downward & upward; Barriers ofcommunication; Essentials of communication; Process of Communication;

Forms of Communication: Intrapersonal communication, interpersonal communication, groupcommunication, mass communication, non-verbal communication,body language etc.

Oral Communication Skills: Planning and conducting interviews, selection interviews, reprimandinterviews, clinical & psychological interviews, grievance interview, exit interviews; public speaking skills

Theories of communication: Theories of Communication: Hypodermic Needle theory, Two-step & Multi-step Theory, PlayTheory, Uses & Gratification Theory, Selective Exposure, Selective Perception & Selective; Retention Theory, Individual Difference Theory.

Major Theories of Press: Meaning of theories based on scientific study & analysis; major theories of Press, Authoritarian Theory, Libertarian Theory, Social Responsibility Theory, Soviet Communist/Workers Theory.

Journalism Practice: Basic concepts of Journalism;Relationship between Press and Society - Press and Government. Codeof Ethics of the press, Press Council of India

Media Types: Traditional media, community media, folk media, new media, social media. Global advertising, global news agencies, global media houses, choice of global media,

Writing for various media: Writing for press, TV, radio and social media

Campaign Design: Audience research; audience segmentation; pre-testing; message dissemination; channels; encoding; decoding; feedback. Campaign for electronic media, print media, new media

Concepts of Media advocacy, social marketing, public service advertising, health promotion, development communication

Public Relations – Basic Principles and concepts

Commonly used terms in media and communication

Basic Writing skills in English

PSYCHOLOGY

Introduction

- Psychology: Definition, Nature, Scope and Goals
- Approaches to Scientific Research: Nomothetic & Idiographic
- Methods of Psychology: Observation, Case Study, Survey, Interview and Experimental

Brief Introduction to Schools of Psychology

- Concept of Body – Mind Interaction
- Structuralism, Functionalism, Psychoanalysis, Behaviorism, and Gestalt.

Contemporary Approaches to Psychology

- Cognitive Approach
- Humanistic Approach
- Existential Approach
- Bio- psychological Approach
- Socio-cultural Approach
- Evolutionary Approach.

Basic Statistics

- Use of statistics in Psychology
- Frequency Distribution
- Graphic Presentation of Data
- Measures of Central Tendency
- Measures of Variability.

The Nervous System

- Structure, Types and Functions of Neurons
- Nature of Nerve conduction
- Simple Reflex Action

Structure of Central Nervous system

- Brain - Cerebrum, Cerebellum, Thalamus, Medulla Oblongata and Spinal cord.
- Localization of function in the Brain
- Reticular Activating System

Peripheral and Autonomic nervous systems

- Sympathetic and Parasympathetic divisions.

Endocrine system

- Location, Structure and Functions of Endocrine glands
- Effect of `under' and `over' functioning of Endocrine glands on behavior.

Sensation and Attention

- General characteristics of Sense organs- Transduction, AL, DL, Jnd, Signal Detection Theory, Habituation and Sensory Adaptation.
- Definition and Nature of attention: Shifting, Fluctuation, Division, and Span of attention
- Factors influencing Attention - Objective and Subjective factors.

States of Consciousness

- Nature and Importance of Altered states of Consciousness – Waking state, Sleep, and Dreams
- Induced state of Consciousness – Work Shift, Drugs, Hypnosis, and Meditation.

Perception

- Definition, and Nature of perception; principles of Perceptual organization.
- Perception of Movement
- Depth Perception – Definition, Monocular and Binocular cues of depth perception.
- Concept of Perceptual Constancy, Types of Constancies – Size, Shape, Color, and Brightness
- Perceptual Abnormalities – Illusions, and Hallucinations.

Learning

- Definition, and Nature of learning
- Theories of learning – Conditioning Theories(Trial and Error, Classical conditioning, and Operant conditioning),Comparison between classical conditioning and operant conditioning
- Cognitive Theories - Sign learning and Insightful learning
- Social learning – Bandura, Walter Mitchell
- Learning Styles – Perceptual, Tactile, Kinesthetic, Visual, and Auditory
- Effective ways of learning.

Memory

- Definition and Nature of memory
- Information Processing – Encoding, Storage and Retrieval
- Stages of memory – Sensory, Short-Term and Long-Term

- Kinds of memory – Episodic, Semantic and Procedural
- **Forgetting** - Definition and Nature
- Causes of forgetting – Decay theory, Interference theory
- Methods of improving memory.

Thinking

- Definition and Nature of thinking
- Role of Imagery and Language in thinking
- **Concept** – Definition, and Types of Concepts
- Steps involved in Concept formation
- Reasoning – Definition, Types of Reasoning – Inductive and Deductive
- Problem- solving; Decision making, and
- Creativity.

Intelligence

- Definition, Nature of Intelligence
- Brief history of Testing Movement – contribution of Binet
- Theories of Intelligence– Thorndike, Spearman, Thurstone, Sternberg, andGardener.
- Measurement of Intelligence.

Motivation

- Definition, Nature and Types
- Concept of Instinct, Drive, Motive, Incentive, and Homeostasis
- Conflicts in Motives
- Theories of motivation – Drive Reduction Theory, Maslow's Need-hierarchy theory, Concept of Unconscious Motivation
- Specific forms of Motivation – Affiliation, Achievement and Power
- Measurement of Motivation.

Emotion

- Definition, Nature, and Components of emotions
- Development of emotions
- Role of Brain and Endocrine glands in Emotions
- Theories of Emotions – James-Lange, Cannon- Bard, Schachter -Singer, and Donald Lindsley
- Adaptive and Disruptive functions of Emotions
- Measurement of Emotions.

Self and Personality

- Concept, and dimensions of Self
- Factors influencing the development of Self
- Roger's theory of self
- Definition &Nature of Personality

- Factors influencing the development of personality – Genetic and Constitutional factors, Socio-Cultural factors, Significant Personal experiences.

Approaches to Personality

- Approaches to Personality – Trait (Cattell and Allport), Type (Kretschmer and Sheldon),Factorial, Dimensional, Psychoanalytic and Psychosocial
- Measurement of Personality.

Concept of Adjustment and Maladjustment

- Elements of adjustment
- Non-adjustment and Maladjustment reactions
- Causes of non-adjustment and maladjustment behavior - Frustration, Conflicts, and Anxiety; their impact on behavior and Personality.

Basic Processes of Social Interaction

- Introduction to social psychology – Definition, Nature and Scope
- Concept of Social Interaction
- Ways and Levels of Social interaction
- Social influence- Conformity, Compliance, and Obedience.
- Social perception- Attribution Theories: Heider, Kelly, Jones and Nisbett.
- Impression formation and Impression management.

Attitudes and Social Behaviour

- Concept of Social Behaviour
- Definition, Components and Functions of Attitudes
- Attitude Formation and Development-Basic concepts of Attitude change, Festinger's Cognitive Dissonance, Bem's Self-perception, Heider's Balance Theory; Psychological Reactance
- Attitude Measurement and Attitude Scales.

Prejudice

- Meaning and Nature
- Psychological and Social basis of Prejudice
- Consequences of Prejudice
- Methods of reducing Prejudice.

Groups

- Definition, Nature and Types of groups
- Group structure- Status, Roles, Norms; Group cohesiveness; Group conformity
- Decision– making in groups
- Risky Shift, and Polarization

- Group processes – Co-operation, Competition and Conflict
- Leadership in groups, Leadership styles
- Concept of Group Morale.

Introduction to Health Psychology
- Concept of Health and Illness Continuum
- Concept of Well-being – Physical, Psychological, Social, Emotional and Economical.
- Determinants of health behaviour – Biological factors, Psychological factors, Cultural factors (superstitions, beliefs and practices) and Environmental factors (crowding, pollution, noise, rapid technological change).

Concept of Stress

- Sources of stress- Frustration, Role ambiguity, Conflict, Social support
- Self- Concept, Types of Personality and Stress.
- Physiological reactions to stress (GAS- General Adaptation Syndrome)
- Emotional and Behavioural reactions to stress (Anxiety, Withdrawal and Suicide).

Coping with stress

- Social Engineering Techniques (Conflict management)
- Personality Engineering Techniques (Cognitive and Behaviour models).

Health Promotion

- Adopting Healthy Life Style
- Changing Attitudes or Beliefs
- Using Cognitive and Behavioural Change Techniques
- Appeals, Mass-media and Self-help Groups.

Counselling

- Concept and Nature of Counselling
- Basic assumptions
- Goals and Objectives of Counselling
- Role of a Counsellor
- Qualities of an Effective Counsellor.

Introduction

- Concepts of Normality and Abnormality
- Concepts of Mental Illness and Mental Health
- Criteria of Abnormal behavior
- A brief mention of DSM and ICD classification systems.

Causes of Abnormal Behavior

Primary, Predisposing, Precipitating and Reinforcing causes
- Biological factors
- Psychological factors
- Socio – Cultural factors.

Anxiety/ Neurotic disorders

- Anxiety neurosis
- Phobias
- Obsessive – Compulsive disorders
- Hysterical Neurosis
- Hypochondriasis
- Neurasthenia.

- Socialization of Family Members – Consumer Socialization of Children, Adults and Intergenerational Socialization.
- Family Decision Making and Consumption-related Roles- Key Family Consumption Roles
- Dynamics of Husband-Wife Decision making
- Family Life Cycle, Nontraditional Family Life Cycle.

Consumer Decision Making Process

- Levels of Consumer Decision Making – Extensive Problem Solving, Limited Problem Solving and Routinised Response Behaviour.
- An Emotional View of Consumer Decision Making
- A Model of Consumer Decision Making- Input, Process, Output

COMPUTER SCIENCE&ENGINEERING

Unit-I:DigitalElectronics (Basics)

Number systems - Conversions-Codes – Logic gates AND, OR, NOT, NOR, NAND and XOR – BooleanExpressions-De-Morgan'stheorems–K-Map-CombinationalCircuits–Adders-Encoders & Decoders - Multiplexers and De-multiplexers- Latches - Flip-flops – Edge and Leveltriggering-Counters -Registers – Semiconductormemories.

Unit-II:Microprocessors (Basics)

8086 Microprocessor – Architecture, Segmentation concepts – Instruction set of 8086 – Instructionformats – Addressing modes of 8086 – Interrupts Assembly Language Programming – Peripheraldevices&interfacing–INTEL8255, 8257, 8251A,and 8279.

Unit-III:ComputerOrganization

Functional blocks of Digital Computer – Stored program concept – Fixed point, Floating pointnumber representations – Instruction formats - Addressing modes– Memory hierarchy – Virtualmemory, Associative memory – Cache memory – I/O Organization – Modes of data transfer –ProgrammedI/O,DMA,InterruptinitiatedI/O–PipelineandVectorprocessing–Flynn'sclassification.

Unit-IV:CProgramming andDataStructures

Algorithms – Flowcharts - C Tokens - Data types - Operators and expressions – Precedence andAssociativityofoperators–Typeconversions-Controlstatements–Arrays–Memory allocations –Strings–Functions,parameterpassing–Pointers-Structures,Unions-Storageclasses–Preprocessordirectivestatements – Files

Data Structures– Abstract Data Types - Time and Space complexities – Stacks and Queues - Linked Lists – Binary trees – Tree traversal techniques - Sorting: Bubble, Selection, Insertion,Quickand Merge sorts -Searching: Sequentialand Binarysearch techniques.

Unit-V:ComputerHardware& Networking

BIOS–ComponentsofMotherboard –Processors–HardDiskDrives–Input&Outputdevices –

Networking–Classificationofnetworks-OSIreferencemodel,TCP/IPreferencemodel–Network topologies: Bus, Ring, Star, Mesh, Hybrid – LAN components: Coaxial, Twisted pair,Optical fiber cables and Connectors – LAN devices: Repeaters, Hubs, Bridges, Switches, NIC,Routers, Modems - TCP/IP addressing scheme – IP address classes – IP Sub-netting – Linuxcommands.

Unit-VI:OperatingSystems:

OperatingSystemconcepts,Services,Types,Systemcalls–ProcessManagement–CPUschedulingalgorithms:FCFS,SJF,RoundRobin,Priority,Multilevelscheduling–Threads–

Semaphores - Inter Process Communication – Deadlocks - Memory Management – Overlays,Paging, Segmentation, Virtual memory, Page replacement algorithms: FIFO, LRU, Optimal –Thrashing - Disk scheduling - Disk scheduling algorithms: FIFO, SSJF, SCAN, C-SCAN - Filemanagement– file operations, accessmethods, directorystructure.

Unit-VII:RDBMS

Concepts of Database systems, Data abstraction - Data independence, Data models, E-R model – Structure of Relational database – DDL, DML and DCL commands – Keys - Normal Forms: 1st,2nd, 3rd and BCNF - SQL – data types, operators – joins - views, sequences, synonyms andindexes–PL/SQL–

datatypes,controlstructures,cursormanagement,triggers,exceptions,functions,procedures, recursion and packages.

Unit-VIII:Object OrientedProgrammingThroughC++

Concept of OOPs – classes and objects – Constructors and destructors –Function overloading andOperator overloading – Inheritance types -Virtual functions – friend functions –inline functions -thispointer–I/O manipulators– FileandI/Ofunctions –Templates.

Unit-IX:JavaProgramming

Java – data types, variables, operators, arrays – Classes and Objects – Methods – Constructors – Methodoverloading,Methodoverriding–Staticfinalmembers-Inheritance–super,finalkeywords – Interfaces –Packages- Exceptionhandling - Multithreading –Applets – AWT –Eventhandling - JDBC – Servlets.

Unit-X:InternetProgramming

Internet fundamentals – HTML, Tags, Attributes, Formatting text – Cascading Style Sheets - Webservers-Javascript–datatypes,Operators–controlstructures–procedures,functionsandarrays – PHP – data types, variables, operators, control structures, arrays, functions, concept of accessingdatabases– sessions andcookies.

Unit-XI: Data backup, Data security, Server Management, Data retrieval, FTP Management

Unit-XII: Design and Analysis of Algorithm

- Dynamic programming- Optimal binary search trees, Travelling Sales person problem,

- Greedy method-Applications-Job Sequencing

- Divide and conquer- Quick sort, Merge sort

- Performance Analysis –Space complexity

- Big on Notation, Omega Notation

- FIFO Branch and Bound Solution

- Back Tracking

Unit-XIII: Distributed System

- OS layers

- Process and Threads

- Distributed File System- Introduction

- Transactions & concurrency

- Reprication – Fault tolerant services, Distributed shared memory, peer to peer system- Introduction

Unit-XIV: Mobile Computing

- Introduction to Android Operating system

- User interface components

- Persistent storage

- Secure and retrieving data

- Grid and Table Layouts.

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MECHANCIAL ENGINEERING

Unit-I: WORKSHOP TECHNOLOGY

Basic Workshop tools and operations (Carpentry, Fitting, Marking and Measuring tools, Forging and Sheet metal) - Drilling, Mechanical working of Metal, Foundry Equipment, Pattern types, types of moulding sands and their properties, types of cores, casting methods, defects in castingand special casting processes.

Unit-II: MANUFACTURING TECHNOLOGY

Lathe and Lathe Work, Broaching Machines, Shaping, Slotting, and

Planing.Cutting Fluids, Coolants & Lubricants, Welding Milling,

Gear Making.

Grinding, Surface Finishing processes. Plastics Processing, Press Tools Jigs and Fixtures,Metrology.

Unit-III: MACHINE DRAWING AND PRODUCTION DRAWING

Machine Drawing: Thread nomenclature, Specification , areas of application and types of the following temporary and permanent fasteners : Bolts and Nuts -Keys and cotters, Rivets and Riveted joints, Piping layouts, Different types of welds and their basic symbols.

Production Drawing: limits, fits & tolerances, surface finish, specifications of standardcomponents like Bolts, Nuts, Bearings.

Unit-IV: CAD/CAM

CAD: Stages of CAD, input and output devices, display devices, types of CAD software, types of computer communication networks. **CAM**: Functions and benefits of CAM, CAPP, necessity of CAD/CAM integration, Basic components of NC, CNC and DNC machines, CNC part programming, Manual and computer assisted part programming, CIMS, FMS, Computer Aided inspection and Robotics.

Unit-V: THERMODYNAMICS

Basic thermodynamics and Laws of Perfect gases, Thermodynamic processes, Fuels and Combustion, Air standard cycles: Carnot, Otto and Diesel cycles, I.C Engines: Two and Four stroke engines, Petrol and Diesel engines, Indicated and brake powers, Indicated and brake thermalefficiencies. Fuel, ignition, lubrication and cooling systems.

Unit-VI: HEAT POWER ENGINEERING

Air Compressors, Gas turbines and Jet propulsion. Properties of Steam, Working and Performance of Boilers, Steam nozzles, Steam Turbines and Steam Condensers.

Unit-VII: SOLID MECHANICS

System of forces, Resolution of Forces, Concept of Equilibrium, Lami's Theorem, Geometrical Properties of Sections, Simple Stresses and Strains, Shear Force and Bending Moment diagrams, Simple Bending, Deflection of Beams and Torsion in shafts.

Unit-VIII: DESIGN OF MACHINE ELEMENTS

Design of Bolts, Screws and Nuts, Shafts, Keys, Couplings, Bearings, Design of Belt and Gear drives and Cams.

Unit-IX: FLUID MECHANICS AND HYDRAULIC MACHINERY

Properties of Fluids, Flow of liquids, Flow through pipes, Impact of Jets, Hydraulic Turbines, Governing, Working principle and operation of Reciprocating and Centrifugal pumps.

Unit-X: ENGINEERING MATERIALS

Mechanical properties of materials, structure of materials, Production of Iron and Steel, Iron Carbon equilibrium Diagram, Heat treatment processes, Plain Carbon and alloy steels, Ferrous and Nonferrous metals and alloys and Powder metallurgy.

Unit-XI: INDUSTRIAL MANAGEMENT

Principles and functions of management, organization structures, Production and materials management, Marketing sales and Feasibility study, Entrepreneurial development, Principles ofISO 9000, Total Quality Management, Industrial legislation and safety.

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DMLT

- **Fundamentals of MLT:** Students through MLT learn the application of basic techniques and instruments used in all areas of medical laboratories.
- **Basics of Clinical Biochemistry:** Clinical biochemistry is a branch of laboratory medicine in which chemical, as well as biochemical methods, are applied.
- **Basic pathology**: Study of disease is known as pathology. It is a study through the examination of surgically removed organs, tissues, bodily fluids, and in some cases the whole body.
- **Microbial Instrumentation**: Instrumentation is a powerful tool which is used to explore the internal structure of Microorganisms.

- **Clinical Hematology**: Hematology is the study of the numbers and morphology of the cellular elements of the blood.
- **Clinical Microbiology:** The definition of clinical microbiology deals with the interrelation of macro and microorganisms under normal and pathological conditions.
- **Clinical Pathology**: Clinical pathology is a medical specialty concerned with the diagnosis of disease based on bodily fluids, such as blood, urine, and tissue homogenates.

- **Histopathology –** A branch of Pathology which deals with the study of disease in a tissue section
- **Bio waste -** Any material that contains or has been contaminated by a biohazard agent That includes Petri dishes, syringes, needles, blood waste etc.,
- **Blood banking –** A place where blood is collected & stored before it is used for transfusions.

Electrical

- Electrical Circuit Theory
- Electrical Machines-I
- Electronic Devices and Circuits
- Computer Applications
- Electric Machines-II
- Measurements and Instruments
- Digital Electronics
- Transducers and Signal Conditioners
- Communication and Life Skills Practice
- Power System-I
- Microcontroller
- Special Electrical Machines
- Programmable Logic Controller
- Electrical Machine Controller
- Power System-II
- Electrical Estimation and Energy Auditing
- Computer Hardware and Networks

Refrigeration and Air Conditioning Syllabus

- Introduction: Refrigeration and Air Conditioning and Safety
- Fitting & Welding
- Electricals & Electronics
- Primary & secondary refrigerants
- Thermal insulation
- Lubrication
- Gas Charging, Testing & Faults Diagnosis
- Commercial RAC plants & Car air-conditioners 02
- Observation, Analysis of Carnot cycle
- Non-Conventional Refrigeration system.
- Electronic Controls, Transistors
- Commercial Compressor & Capacity Control
- Cooling Tower
- Water Softening Plants, Chillers
- Refrigerant controls
- Food Preservation, Refrigerants, Lubrication
- Erection of plants, Ducts, HVAC, VAV system
- Psychrometry, Heat load estimation
- Commissioning & preventive maintenance of different plants
- Domestic Refrigerator and Split Air Conditioner

INSTRUMENTATION

Sl. No.	Topics
1	Basic Control System
2	Digital Electronics
3	IC
4	Transducers and Telemetry
5	Control System Components
6	Microprocessor and Assembly Language Programming
7	Process Technology
8	Analytical Instrumentation
9	Electronic & Pneumatic Instrumentation
10	Microprocessor Interfacing & Applications
11	Process Instrumentation
12	Applied Instrumentation
13	Industrial Electronics and Control
14	Biomedical Instrumentation
15	Micro Controllers
16	Advance Process Control

1. Basic Computer Skills: Characteristics of Computers, Input, Output, Storage units, CPU, Computer System. Computer Organization Central Processing Unit Processor Speed, Cache, Memory, RAM, ROM, Booting, Memory- Secondary Storage Devices: Floppy and Hard Disks, Optical Disks CD-ROM, DVD, Mass Storage Devices: USB thumb drive. Managing disk Partitions, File System Input Devices - Keyboard, Mouse. System Software, Application Software, Compiler, names of some high level languages, free domain software.

2. MS Office Applications:

a. Word Processing: Word processing concepts: saving, closing, Opening an existing document, Selecting text, Editing text, Finding and replacing text, printing documents, Creating and Printing Merged Documents, Character and Paragraph Formatting, Page Design and Layout. Editing 4 and Profiling Tools: Checking and correcting spellings.

b. Excel Spreadsheet: Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving data from selected cells.

c. Presentation(PPTX): PPT Creating, Opening and Saving Presentations, Creating the Look of Your Presentation, Slides, Adding and Formatting Text, Formatting Paragraphs. Drawing and Working with Objects, Adding Clip Art and other pictures, Designing Slide Shows, Running and Controlling a Slide Show, Printing Presentations.

3. Internet Basics:

WWW and Web Browsers: Web Browsing software, Surfing the Internet, Basic of electronic mail, Using Emails, Document handling, Network definition, knowledge in Common terminologies: LAN, WAN, Node, Host, Workstation, And bandwidth.

4. PC Assembly and Maintenance:

- Introduction to PC Hardware:
- Basics of I/O systems, Types of Memories- Static RAM and Dynamic RAM, ROM,
- CPU (Central Processing Unit) ALU and control unit.
- Installation of OS (Operating Software): Windows XP, installation of different types of Service Packs, Vista and Windows-7 etc.
- Windows OS Shortcuts, Basics of OS Fundamentals & Operations

5. Troubleshooting of PC:

POST (Power on Self-Test), Identifying problems by Beep codes errors, Checking power supply using Multi-meter, Replacement of components etc. and Maintenance of PC.

6. Basic networking Concept:

What is Networking, Local Area Networking (LANs), Metropolitan Area Network, MAN), Wide Area Network (WAN), Transmission media & method of communication. Knowledge of components like switches, bridges, routers, Wi-Fi router etc. TCP/IP, IP addressing, MAC address, Subnet To share and access a file/folders over a network.

IT Security & Software Hacking:-

- To identify and remove security issues such as errors and bugs in different web application and IT systems.

- To protect computer system from external threat, hardware damage or internal data issues.