

(xi) In-Service contractual employees claiming age relaxation and contractual In-service benefits must submit a Certificate from employer as per proforma prescribed by the Commission vide the **Advisory Notice No.3568/OSSC dated 01.11.2019** available in the website of the Commission "www.osscc.gov.in". (**Annexure-C** of this Advertisement)

8. Plan of examination: There shall be a written examination of 300 marks consisting of two papers followed by Viva-Voce test of 30 marks. The Commission at their discretion may adopt Computer Based Recruitment Test (CBRT).

Stage-I					
Exam Type	Paper	Subject	Maximum marks	No. of Questions	Duration
Written Examination (OMR Based or CBRT)	Paper –I	General Awareness	100 Marks	100 (Objective Type)	1 & ½ Hours
	Paper-II	Technical Paper	200 Marks	100 (Objective Type)	3 Hours
Stage-II					
Viva-voce Test	30 marks			Candidates numbering 3(Three) times the vacancies advertised from each category in order of merit shall be shortlisted for Viva Voce Test basing on the marks secured in the Written Examination.	
Total			330 Marks		

9. Syllabus of Written Examination:

Paper-I (General awareness):

The questions in this paper shall be to test the candidate's psychology and the general awareness. Questions on reasoning, aptitude and general awareness on science, current affairs, geography, history of India & Odisha, Indian constitution, Socio Economic Political Development, Human rights, fundamentals of Computer etc. The questions will be of graduation standard & objective type multiple choices to be answered in OMR sheet or the Commission at their discretion may adopt online test on this paper.

Paper II (Technical Paper):

There will be separate questions in the respective discipline viz. physics, Chemistry, Zoology & Psychology, and Computer Science. The candidates will have to appear the test on the specific subject as per their option exercised. The questions in this paper will be of objective type multiple choices to be answered in OMR sheet or the Commission at their discretion may adopt CBRT. The detail syllabus is annexed as **Annexure-D** of this advertisement.

10. PLACE AND DATE OF WRITTEN EXAMINATION:

The Date/Time/ Venue of the Written Examination will be informed to the eligible candidates in their Admission Letters, in due course. The admission letters shall only be downloaded by the eligible candidates by accessing the Commission's website by using their 'User ID' and 'Password' from a date to be notified later on.



ANNEXURE-‘D’
SYLLABUS FOR CHEMISTRY

NUCLEAR CHEMISTRY

- a) General characteristics of radioactive decay, Decay kinetics, Parent –daughter decay growth relationship, α -decay, β -decay & γ -emission.
- b) Nuclear fission, Process of nuclear fission, Fission fragments and their mass distribution, Charge distribution, Ionic charge of fission fragments, Fission energy, Fission cross-sections and thresholds, Fission neutrons, Theory of nuclear fission. Fission.

TRANSITION METAL CHEMISTRY

THEORIES OF METAL-LIGAND BONDING

- a) Crystal field theory (CFT): Splitting of d-orbital under the influence of octahedral, tetrahedral, tetragonal, square planar, trigonalbipyramidal and square pyramidal fields, Stereochemical and thermodynamic effect of CF splitting, CFSE and Jahn-Teller effect.
- b) Molecular orbital theory (MOT): Sigma bonding in octahedral complexes: Classification of metal valence orbitals into sigma symmetry, formation of ligand group orbitals (LGOs) of sigma symmetry, Formation of molecular orbitals of sigma symmetry, construction of molecular orbital energy level diagram involving only sigma bond contribution from ligands, pi bonding in octahedral complexes, Classification of metal valence orbital into pi symmetry, Formation of LGOs of pi symmetry. Formation of pi MOs and construction of molecular orbital energy level diagram involving sigma and pi contribution from pi donor ligands, Sigma and pi bonding in tetrahedral complexes.
- c) Ligand field theory (LFT) and adjusted crystal field theory (ACFT).

COMPLEX EQUILIBRIA

- a) Complex Equilibria: Types of complex equilibria in solution and types of complex equilibrium constant (stability constant). The complex formation functions, Determination of stability constant by spectrophotometric method and pH titration method, Stabilization of unusual oxidation state.

STRUCTURE AND REACTIVITY

NATURE OF BONDING IN ORGANIC MOLECULES

Delocalized chemical bonding, Conjugation, Cross conjugation, Resonance, Hyper conjugation, Bonding in fullerenes, Tautomerism, Aromaticity in benzenoid and non-benzenoid compounds, Alternant and non-alternant hydrocarbons, Huckel's rule, energy levels of pi-molecular orbitals of simple systems, Annulenes, Anti-aromaticity, Homo-aromaticity, Bonds weaker than covalent addition compounds, Crown ether complexes and cryptands, inclusion compounds, Cyclodextrins, catenanes and rotaxanes.

REACTION MECHANISM: STRUCTURE AND REACTIVITY

Types of mechanisms, Types of reactions, Thermodynamic and kinetic requirements, Kinetic and thermodynamic control, Hammond's postulate, Potential energy diagrams, Transition states and intermediates, Methods of determining mechanisms, Hard and soft acids and bases.

Effect of structure on reactivity: Resonance and field effects, Steric effect, Quantitative treatment, The Hammett equation and linear free energy relationship, Substituent and reaction constants, Taft equation.

REACTION INTERMEDIATE

Non-classical carbocations, Free radicals, Carbenes, Nitrenes, Arynes.

GENERAL DISCUSSION ON THE FOLLOWING

Solvent effect, isotope effect, Kinetic salt effect, Stereoselective, Regioselective, Stereospecific and Regiospecific reactions, Stereo electronic factors in transition state stability.

STEREOCHEMISTRY

Chirality, Fischer projection and R and S notations, Threo and erythro nomenclature, E and Z nomenclature, Optical isomerism in biphenyls and allenes, Concept of Prostereoisomerism and Assymmetric synthesis (including enzymatic and catalytic nexus), Conformation of a few acyclic molecules (alkanes, haloalkanes), Conformation of cyclic systems having one and two sp² carbon atoms.

Dynamic stereochemistry: Conformation and reactivity, Selection of substrates, Quantitative correlation between conformation and reactivity, (Weinstein-Eliel equations and Curtin- Hammett principles), Conformational effects on stability and reactivity in acyclic compounds (ionic elimination, intramolecular rearrangements, NGP) and in cyclic systems, (Nucleophilic substitution reaction at ring carbon, Formation and Cleavage of epoxide rings, Addition reactions to double bounds, Elimination reactions).

THERMODYNAMICS

CLASSICAL THERMODYNAMICS

Brief resume of the concepts of laws of thermodynamics, Free energy, chemical potential and entropy, Third law of thermodynamics and determination of entropy, Entropy and probability, Boltzmann-planck equation, Partial molar properties (partial free energy, molar volume and molar heat content). Their significance and determination. Concept of fugacity and its determination.

THERMODYNAMICS OF LIVING SYSTEMS

Bioenergetics and thermodynamics, Phosphate group transfer and ATP, Biological oxidation-reduction reactions.

DYNAMICS

CHEMICAL KINETICS

Theories of reaction rates, Collision theory, Transition state theory, Arrhenius equation and the activated complex theory, Reaction between ions, Salt effect, Steady-state Kinetics, Kinetic and Thermodynamic concept of Reactions, Treatment of unimolecular reaction (Lindemann-Hinshelwood and Rice-Ramspeger-Kassel-Marcus (RRKM) theories), Dynamic chain ($H_2 + Br_2$ reaction, pyrolysis of CH_3CHO , Decomposition of ethane).

ELECTROCHEMISTRY

Interionic attraction theory and Debye- Huckel treatment, Derivation of Onsager limiting law and its verification and modification, Activities , activity coefficients, Debye- Huckel treatment, Debye- Huckel-Bronsted equation, Salt effect, Determination of activity coefficients from solubility method, Ion association, Determination of thermodynamic dissociation constant of weak electrolytes by Shedlovsky method and by EMF method, Nernst equation, redox systems, electrochemical cells.

BIO-INORGANIC CHEMISTRY

TRANSPORT AND STORAGE OF METALS

Metal ions in biology with special reference to Na, K, Mg, Ca, Fe, Zn, Co and Mo, The transport mechanism, Transport and storage of alkali and alkaline earth metal, Transport by neutral macrocycle, Transport by anionic carriers, sodium/ potassium pump, calcium pump, ionophores and their role as ion carrier, transport and storage of iron, Ferritin, transferrin (siderophilin), siderophores, Storage of copper and zinc, metallothioneines, transport of copper and zinc.

METALLOPORPHYRINS AND IRON-SULPHUR PROTEIN.

- Iron porphyrins (Heme proteins): Hemoglobin (Hb), Myoglobin (Mb) their behaviour as oxygen carrier and oxygen uptake protein, O_2 affinity cooperativity and Bohr's effect, Heme protein as electron carrier with particular reference to cytochrome-c and cytochrome-450 and cytochrome oxydase.
- Magnesium porphyrins (Chlorophyll): Photosynthesis, the light and dark reaction (Calvin cycle).
- Non – heme iron – sulphur protein as electron carrier, rubredoxins and ferredoxins.

ORGANIC REACTION MECHANISM-I

The S_N2 , S_N1 , mixed S_N1 and S_N2 and SET mechanisms. The neighboring group mechanism, Neighboring group participations by sigma and pi bonds, anchimeric assistance. Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements, application of NMR spectroscopy in the detection of carbocations. The S_N1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis, ambident nucleophile, regioselectivity.

- Aliphatic Electrophilic Substitution mechanism: S_E1 , S_E2 and S_E1 mechanisms, Effect of substrate, leaving group and solvent, Reactions (hydrogen exchange, migration of double bonds, keto-enol tautomerism, halogenation, aliphatic diazonium coupling, Stork – enamine reaction)
- Aromatic electrophilic substitution mechanism: Structure reactivity relationship in mono-substituted benzene, ring isomer proportions, orientation in benzene ring with one or more than one substituent, Orientation in other ring systems, Vilsmeier-Haack reaction, Pechmann reaction.
- Aromatic Nucleophilic Substitution mechanism: Introduction, to different mechanisms, Aromatic nucleophilic substitutions (S_NAr , S_N1 aryne) Effect of substrates, leaving groups, and nucleophile, Reactions: Nucleophilic displacement in arene-diazonium salts by different nucleophiles, Chichibabin reaction.
- Free radical substitution: Reaction at sp^2 carbon, Reactivity in aliphatic substrates, Reactivity at bridge head position, Reactivity in aromatic substrates.

ORGANIC REACTION MECHANISM-II

- Addition to carbon-carbon multiple bonds, Electrophilic, Nucleophilic and Free radical addition, Orientation and Reactivity, Addition to cyclopropanes, Reactions: Hydroboration, Michael reaction, Sharpless Asymmetric epoxidation.
- Addition to carbon-heteroatom multiple bonds: Mechanism and reactivity, Reactions: Mannich reaction, $LiAlH_4$ reduction of carbonyl compounds, acids, esters, nitriles, addition of Grignard reagents- Reformatsky reaction, Aldol condensation, Knoevenagel condensation, Perkin reaction, Tollens reaction, Wittig reaction, Prins reaction, Benzoin condensation.



Elimination mechanism: E1, E2, E1CB and E2CB mechanisms, Orientation, Effect of substrate, base, leaving group and medium, Orientation of double bond, Saytzeff and Hoffman rules, Pyrolytic elimination reaction, Oxidative elimination (oxidation of alcohol by chromium, Moffatt oxidation). Reactions: Cleavage of quaternary ammonium hydroxides, Chugaev reaction, Shapiro reaction.

REARRANGEMENTS

General mechanistic considerations- nature of migration, migratory aptitude, memory effects.

A detailed study of the following rearrangements, Wagner- Meerwein, Favorskii, Arndt- Eistert synthesis, Neber, Beckmann, Hofmann, Schmidt, Lossen, Curtius, Baeyer-villiger, Shapiro reaction, Von-Richter, Sommelet- Hauser rearrangement.

SURFACE CHEMISTRY

PHASE RULE

Concept of Equilibrium between phases, Derivation of phase rule, Ideal Solution, Lever Rule, Brief concept on one and two component system, Application of phase rule to three component systems of both solids and liquids.

ADSORPTION

Surface tension, Capillary action, Adsorption, types of adsorption, Gibbs adsorption isotherm, Freundlich's adsorption isotherm, Langmuir's adsorption isotherm and its limitations, BET adsorption isotherm and its applications, Heat of adsorption, estimation of surface areas of solids from solution adsorption studies, Brief concepts on micelle, reversed micelle and microemulsions.

MACROMOLECULES

Polymer-definition, Types of polymer, Number average and weight average macromolecules, determination of molecular weights of macromolecules (Osmometry, Viscometry, Diffusion and Light scattering method), Kinetics of polymerization, Donnan Effect, Stereochemistry of polymerization.

INSTRUMENTAL METHOD OF ANALYSIS

SPECTROSCOPICAL METHOD

Chromatographical method: Principle and application of HPLC, GC, GC-MS, GPC

- Atomic absorption and Flame emission spectral method and their application in quantitative analysis.
- Molecular absorption and emission spectroscopy in quantitative analysis.
- Light scattering technique including nephelometry and Raman spectroscopy.

ELECTRO ANALYTICAL METHOD

Polarography: Basic principle, instrumentation, theory of current-voltage curve, Theory of diffusion current, Ilkovic equation, polarography wave and half wave potential, Application of polarography, Cyclic voltammetry anodic stripping voltammetry, amperometry, conductrometry and ion selective electrodes.

THERMO ANALYTICAL METHODS

Thermo gravimetric analysis (TGA): Principle, instrumentation, factors affecting TGA curve, derivative thermo gravimetric analysis (DTGA) and application of thermogravimetric analysis. Differential thermal Analysis (DTA), instrumentation of DTA and application of DTA. Simultaneous study of TGA, DTA with examples, Differential scanning calorimetry (DSC) and thermometric titration.

NATURAL PRODUCTS AND SPECTROSCOPY

NMR: Magnetic properties of nuclei, Theory of magnetic nuclear resonance with special reference to proton, Instrumentation, Chemical shift, Simple spin-spin interaction, shielding effects, Diamagnetic anisotropy, NOE, ^{13}C , ^{15}N , ^{19}F , ^{31}P NMR (preliminary idea).

- a. Mass spectrometry: Introduction, Mass spectrum, Determination of molecular formulae, parent peak, Base peak, Use of molecular fragmentation, Mass spectra of some classes of compounds (hydrocarbons, alcohols, phenols, ketones, aldehydes, acids and esters).
- b. Problems involving UV, IR, NMR and Mass spectroscopy.

SPECTROSCOPY

ELECTRON SPIN RESONANCE SPECTROSCOPY

Theory, instrumentation, g-values, hyperfine splitting, ESR spectra of systems with more than one unpaired electrons, double resonance, ENDOR and ELDOR techniques.

PHOTO ELECTRON SPECTROSCOPY

Basic principle, Instrumentation: the basic design of photoelectron spectrophotometer, X-ray photoelectron spectrophotometer, ultraviolet photoelectron spectrophotometer, chemical information from photoelectron spectroscopy, ultraviolet photoelectron spectra and their interpretation, application of X-ray photoelectron spectroscopy, auger lines.

MOSSBAUER SPECTROSCOPY

Principles of Mossbauer spectroscopy, Experimental methods, Theoretical aspects, Quadrupole splitting, Magnetic hyperfine interaction.

BIOMOLECULES

AMINO ACIDS AND PROTEINS

Classification and functions of amino acids and proteins, Chemical reactions of amino acids, alkali titration of amino acids, Synthesis of peptides, Primary, secondary, tertiary and quaternary structures of proteins.

LIPIDS

Classification and Function of lipids, Structural lipids in membranes, lipids with specific biological activities, Resolution and Analysis of lipids, Biological membrane and transport.

NUCLEIC ACIDS

Structure and Function of nucleotides and nucleic acids, Replication, Transcription and Translation processes, Sequencing of nucleic acids, Genetic code, Recombinant DNA.

COMPUTER APPLICATION IN CHEMISTRY

INTRODUCTION TO COMPUTERS

Basic structure of a computer: The CPU, the I/O devices, the internal memory, commonly used secondary storage media. Data representation: Overview of binary, octal and hexadecimal number system. The software: Concept of low level and high level languages, Compiler interpreter, editor, operating system concepts, salient features of MS-DOS. Windows operating systems.

PROGRAMME DEVELOPMENT PROCESS

Algorithm, Flowchart, Decision-table, elements of high level programming languages. Input output statements, conditional statements, control structure, concept of data file, file operation like searching, storing, with reference to Fortran/ C Programming.

Fortran 77/C: Types of data, variable, input and output statement, loop, Nested loop, subscript variable.

ORGANOMETALLIC COMPOUNDS AND HOMOGENEOUS CATALYTIC REACTIONS

Coordinating unsaturation, acids base behavior of metal complexes, oxidative addition reaction, stereochemistry and mechanism of addition, insertion reactions, intermolecular hydrogen transfer, isomerization, hydrogenation of alkenes, hydroformylation, Zigler-Natta polymerization, Alkene metathesis.

ANALYTICAL CHEMISTRY

RELIABILITY OF ANALYTICAL DATA

Errors in chemical analysis, classification of errors, significant figures, precision and accuracy, methods of expressing accuracy, absolute error and relative error, methods of expressing precision, average deviation, standard deviation, confidence limits, median value, range, coefficient of variation.

Sampling in analysis definition: Theory of sampling, technique of sampling, statistical criteria of good sampling and required size, stratified sampling, transition and storage samples.

SOLVENT EXTRACTION AND ION EXCHANGE

- Solvent extraction: Basic principles, classification of extraction, mechanism of extraction, extraction equilibria, technique of extraction, applications in analytical chemistry.
- Ion exchange: synthesis and characteristics of ion exchange, ion exchange equilibria, technique of ion exchange, application of ion exchange for separation.

ULTRAVIOLET AND VISIBLE SPECTROPHOTOMETRY

Introduction, nature of absorbing species, visual colorimetry, photo-electric cell and filters, Photoelectric filter photometry, errors in photoelectric photometry, spectrophotometry, working of spectrophotometer, simultaneous spectrophotometry, differential spectrophotometry, reflectance spectrophotometry, photometric titrations, composition of coloured complex Sandell's sensitivity, relative concentration and Ringbon's plot.

SYLLABUS FOR PHYSICS

CLASSICAL MECHANICS:

The Kinematics of Rigid Body Motion. Definition of rigid body, degrees of freedom, orthogonal transformation and properties of transformation matrix. The Euler angles, The Cayley-Klein parameters and related quantities, Euler theorem on the motion of a rigid body. Finite and infinitesimal rotations. Rate of change of Vector. The Coriolis force effect.

The rigid body equations of motion. Angular momentum and kinetic energy of motion about a point. Tensors and diadics. The inertia tensor and the moment of inertia. The Eigen values of the inertia tensor and the Principal axis transformation. Euler's equations of motion. Torque free motion of a rigid body. The heavy symmetric top with one point fixed.

The Hamilton equations of motion. Legendre transformation and the Hamilton equations of motion. Cyclic coordinates and conservation theorem. Routh's procedure and oscillation about steady motion. Derivation of Hamilton's equations from a variational principle. The principle of least action.



Canonical Transformation: The equations of canonical transformation and examples. Poisson's brackets and other canonical invariants. Equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation. The angular momentum Poisson brackets relations.

Hamilton-Jacobi Theory: Hamilton-Jacobi equations for i) Principal function ii) Characteristic functions Harmonic oscillator problem as an example of the Hamilton-Jacobi method, separation of variables in the H-J equation. Action angle variables. The Kepler problem in action angle variables.

MATHEMATICAL METHODS:

Differential Equations and their solutions. Power series solution.

QUANTUM MECHANICS:

Scalar product vectors and their properties, adjoint operators, unitary operators. Expectation values of dynamical variables and physical interpretation. Hermitian operators. Eigen values and Eigenvectors, probability interpretation.

Representation of momentum operator in the position space and the energy eigenvalue equation, energy operators in the momentum space formulation, commutation relation between operators for position co-ordinate and momentum. Commutator algebra, uncertainty relation as a consequence of non commutability.

Time evolution of quantum states.

Operator method of solution of Harmonic oscillator problem.

Rotation and Orbital angular momentum

Spin angular momentum: spin $\frac{1}{2}$ particle's Pauli spin particles and their properties.

Total angular momentum.

Invariance & symmetry (Translations, rotations) and conservation laws, motion in a spherically symmetric field. The central force problem.

ELECTRODYNAMICS :

Potential formulation of electrodynamics. Magnetic vector potential A and scalar potential. The wave equation for the potentials Gauge transformations. Reflection and transmission of plane electromagnetic waves at the boundary of two linear media (oblique incidence) Dispersion. Free electrons in conductors and plasmas Guided waves: Wave guides TE waves in a rectangular wave guide.

Dipole radiation: Electric dipole radiation, Magnetic dipole radiation. Power radiated by a point charge.

ELECTRONICS:

a) Power electronics : SCR, FET, MOSFET, DIAC, TRIAC (principle, construction, operation with characteristics and application)

b) Oscillators: Klystron oscillator (Principle, description and operation) Multivibrator, Astable, Monostable, Bistable (Principle, Description and Operation)

Operational amplifier: Differential amplifier (Circuit configuration and properties, ideal operational amplifier input and output impedances)

Application of OP-AMP: inverting amplifier, Non inverting amplifier, adder, subtractor, integrator differentiator, logarithmic amplifier, comparator (Principle basic circuit operation and theory)

Single equation loops voltage, source constant voltage source, constant current source, Maximum power transfer theorem. Thevenin's theorem Norton's theorem. (Digital Electronics) Number system.

Binary, Octal and hexadecimal numbers (basic characteristics and inter conversion) Gray Code(interconversion between Gray Code and Binary Code) binary algebra-addition subtraction multiplication and division.'

Logic operations: NOR gate NAND gate, Exclusive OR gate, Exclusive NOR gate (Logic symbol, truth table and circuit with operation)

Logic families: RTL, DTL, TTL (Description and operation) CMOS, Sequential circuit- SR flip-flop clocked SR flip-flop.

Different types of Radio wave propagation- Description and basic theory.

AM and FM transmitter (Block diagram study) FM receiver (Block diagram study) with emphasis on function of limiter and discriminator.

Antenna: Basic antenna action, current and voltage distribution in linear antenna, dipole antenna, power radiator, radiation resistance and directional pattern.

QUANTUM MECHANICS:

Normal and anomalous Zeeman Effect.

SOLID STATE PHYSICS:

Crystal Binding: Crystals of inert gases, ionic crystals, covalent crystals, metallic binding. Hydrogen bonded crystals.

Vibration of mono atomic and diatomic lattices. Dispersion relation, optic and acoustic modes, optical properties in the infrared.

Thermal properties of Insulators: Lattice heat capacity, anharmonic crystal interactions and thermal expansions, Thermal conductivity.

Free Electron Fermi gas: Energy levels and density of states in one-dimension, effect of temperature on Fermi-Dirac distribution function, free electron gas in 3-dimensions, heat capacity of the electron gas.

Electrical and Thermal conductivity of metals, Dielectric response of an electron gas, Plasmon's, electrostatic screening Motion in magnetic field, cyclotron frequency, Hall effect.

Band Theory: Electrons in periodic potential, Bloch's theorem, Kroning-Penny model, origin of band gap.

Semiconductors: Intrinsic and impurity semiconductors, Band gap, law of mass action, intrinsic carrier concentration, impurity states, Energy bands in Si and Ge, P-N junctions.

Superconductivity: Meissner effect, Type-I and Type-II Superconductors, Thermodynamics of super conductors. Josephson Effect, flux quantization, Microwave quantum interference.

NUCLEAR AND PARTICLE PHYSICS:

Nuclear physics I

Nuclear force: Central and Non central force, Mirror nuclei

Nuclear Model: Liquid drop model fission, magic numbers, shell model.

Nuclear Physics II

Nuclear Reaction: energetic of Nuclear Reaction. Alpha decay. Fermi's theory of Beta decay. Particle Physics:

Basic forces, classification of elementary particle.

STATISTICAL MECHANICS:

Classical Statistical Mechanics: Postulate of classical statistical mechanics, Microcanonical ensemble. Derivation of thermodynamics, classical ideal gas, Gibb's paradox

Canonical ensemble and energy fluctuation, Grand canonical ensemble and density fluctuation.



SYLLABUS FOR ZOOLOGY

SYLLABUS FOR MICROBIOLOGY

HISTORY AND DEVELOPMENT OF MICROBIOLOGY:- General features of microbes, Classification, Isolation, culture, and maintenance of microorganisms. Microbial growth, Factors influencing microbial growth, Role of microbes in agriculture and Industry.

METHODS IN MICROBIOLOGY:- Microscopy, microbial culture, pure cultures, sub-culture, stains used for microbes.

STRUCTURAL ORGANISATION:- Prokaryotic micro organisms, structural details of prokaryotic cells. Difference between prokaryotic and Eukaryotic cells, Structure of bacteria and virus (Bacteriophage) and their multiplication (Lytic cycle and lysogenic Cycle)

Nutrition and reproduction of Eubacteria, Genetic recombination in bacteria (Transformation, conjugation and transduction). Cyanobacterial cell structure and reproduction.

VIRUS:- General characteristics and classification of viruses, nature, morphology and chemistry of virus, virus-vector relationship, replication of Bacteriophage.

Plant virus- TMV, structure, transmission pathogenicity and reproduction.

Animal viruses- HIV structure, transmission, pathogenicity and replication. Treatment and prevention by antivirals and vaccine, viruses and prions.

Microbial toxins: types, mode of actions and pathogenicity.

Bacterial toxins- Endo and exotoxins

Fungal toxins- Toxins of aspergillus, penicillium, fusarium and Alternaria.

Algal toxins- Gynotoxins and dinotoxins

Chemotherapeutic agents- Antibiotics and their mode of action, bacterial drugs (penicillin, fluoroquinolones, tetracycline and aminoglycosides.

Application and Importance of microbiology- Bacterial diseases in man (microbes in water and soil), Air borne, Food borne, water borne, soil borne, Sexually transmitted and contact diseases, viral diseases in man, Industrial microbiology, Biomineralization (microbial leaching).

GENETICS

Mendel's experiments and laws of inheritance, gene interactions, Mendelian dihybrid ratio, masking gene action, supplementary gene action, duplicate gene action, complementary gene action.

Multiple alleles in human (ABO blood group), eye colour in Drosophila, self incompatibility in plants, Polygenic inheritance, pleiotropy, Maternal effects and cytoplasmic inheritance, mitochondrial and chloroplast genome. Sex-chromosomes, chromosomal sex-determination.

Meiotic behaviour of chromosomes:- primary and secondary non-disjunction. Genic balance theory of sex-determination, sex determination in humans and Drosophila, lethal genes.

Sex linkage:- Sex-linked gene in man, sex chromosomal disorder in man, sex influence dominance by sex-linked gene expression. Sex-determination in plants with special reference to melandrium.

Linkage groups: complete and incomplete linkage

Crossing over : Relationship between genetic and cytological crossing over, relationship between crossing over and chiasma formation, molecular mechanism of crossing over. Detection of linkage and linkage maps:- Test cross, test for linkage on the basis of F2 generation, gene mapping, three point test cross in Drosophila, Construction of linkage maps, identification of particular linkage groups with specific chromosome, physical distance and map distance. Interference and coincidence, Mitotic recombination, Recombination within gene.



Structural and numerical alteration of chromosomes, Spontaneous and induced mutations, physical and chemical mutagens, chromosomal aberrations, meiotic behaviours of deletion, duplication, inversion and translocation. Euploids and aneuploids, - classification, origin, induction, role of polyploidy in evolution.

Population Genetics-Hardy-Weinberg's law, genetics of qualitative traits in population. Chromosomal disorders, some common human syndromes.

Twin study, multiple births, Genetic counselling, Amniocentesis.

Nature and function of genetic material, chemical compounds causing genetic damage.

Testing of genetic toxicity – Various experimental methods of harvesting cells (tests, bone marrow)

Preparation of Chromosomes and analysis.

BIO-CHEMISTRY

Amino Acids: Classification and properties, acid base properties, the peptide bond ionizations, behaviour of peptides, biologically active peptides.

Levels of protein structure, Determination of primary structure of protein. Three dimensional structure of proteins (Secondary, tertiary and quaternary structures, structural pattern motifs and domains), protein denaturation and folding.

Amino acid catabolism (transamination, oxidative deamination and urea cycle) protein degradation (Proteosomal pathway) and solid phase synthesis of peptides.

CARBOHYDRATES: - Classification configuration and confirmation of mono saccharides.

Sugar derivatives, important disaccharides, Disaccharides, glucoaminoglycans, proteoglycans, glycoprotein and glycolipids.

Carbohydrate Metabolism- Glycolysis, TCA cycle, pentose-phosphate pathway, Glucogenesis, glycogen metabolism, regulation of carbohydrate metabolism, oxidative phosphorylation, electron transport and ATP synthesis.

Enzymes- General properties.

Mechanism of Enzyme action :- Nomenclature, classification, extraction and assay of enzymes, Michael's Menten Kinetics and its significance, Bigg's-Halden modification, determination of V_{max} and K_m ,

Enzyme inhibition: Competitive, non-competitive inhibition, allosteric regulation, covalent modification.

Lipids:- Classification, storage lipids, structural lipids (Glycerophospholipids and sphingolipids) signaling lipids, cofactors, terpenes and pigments, Coenzymes and vitamins.

Biosynthesis and oxidation of fatty acids, regulation of fatty acid metabolism.

ANIMAL DIVERSITY (Non chordates and chordates) AND ANIMAL BEHAVIOUR.

Invertebrates

Nutrition in protozoa- Types and mode of feeding, protozoan parasites in brief (Trypanosoma, plasmodium)

Canal system in sponges

Coral reef formation and its significance

Polymorphism in coelenterates

Excretory structure and function of annelids

Helminth parasites (Taenia and Ancylostoma)

Vision of insects,



Non-Chordates and Proto chordates

Torsion in gastropods, nervous system in cephalopods, water vascular system in Echinoderms, Reproduction and development of Echinoderms and its evolutionary significance, General character and interrelationship of proto chordates siphon mechanism in tunicates

ANIMAL BEHAVIOUR

Classification and analysis of behaviour pattern, Tools and technique in behaviour study, Neural and hormonal control of behavior, communication in animals, social organization in insects and mammals

Biological rhythms, parental care, orientation and navigation, migration of fish and birds.

PHYSIOLOGY AND ENDOCRINOLOGY:

PHYSIOLOGY

Composition of blood, Blood cells, blood groups, mechanism of platelet plug formation and blood coagulation. The lymphatic system.

The cardiac cycle and its regulation.

Pulmonary ventilation: - Respiratory surface and gas exchange, regulation of respiration, transport of gases, Acid base balance.

Excretory system- Urine formation, glomerular filtration, tubular function, renal mechanism of concentrating and diluting urine.

Osmoregulation :- Fresh water, marine and terrestrial vertebrates.

Nutrition :- Micro and macro nutrition.

Diversity in vertebrate digestive structures

Structure of neurone, neuronal conduction, synapse and neuronal integration.

ENDOCRINOLOGY

Chemical messengers, hormones and their feed- back system, mechanism of hormone action (Fixed membranereceptors and mobile receptors), hormone signaling. Pineal, Thymus and Gastrointestinal hormones, Anatomy, of the pituitary gland , Chemistry and biological action of adenohypophysial and neurohypophysial hormones.

Thyroid gland - Anatomy, biosynthesis and function of thyroid hormones.

Parathyroid gland - Anatomy and function and parathyroid hormone.

Endocrine pancreas- Anatomy, Biosynthesis, chemistry and functions of pancreatic hormones.

Adrenal gland:- Anatomy, biosynthesis, functions of cortical and medullar hormones,

Gonads :- Anatomy, and biological actions of gonadal hormones.

General idea about hormones influencing carbohydrate metabolism.

Some hormones of invertebrate

CELL BIOLOGY

Cell theory :- variability, size, shape, complexity and functions, general organisation of prokaryotes and Eukaryotes

Plasma member- Composition and dynamics, memberance carbohydrates and their role in cell organisation.

Social context of cells: Cell junction, cell adhesion and extra- cellular matrix

Cell motility -Cillia and flagella of prokaryotes and eukaryotes.

Cytoskeleton - microtubules, intermediate filaments and microfilaments,

Cell wall- structure, functions, biogenesis, growth

Cell inclusions – Pigment molecules and nutritive materials

Structure - orientation and behaviour of chromosomes, Cell cycle, cell signaling



Nucleus- structure and function of nuclear envelope, nucleolus, and chromatin organisation and its packaging, role of nuclear matrix in chromosome, organisation and function, matrix binding proteins, lamp brush chromosome polygene chromosome, Telecentric chromosome, interphase chromatin, Euchromatin and hetero chromatin, karyotype and its significance.

Molecular Mechanism s of cell division –

Mitosis (behaviour of chromosomes, formation of mitotic spindle, sister chromatid separation), cytokinesis (role of mitotic spindle in determining cytoplasmic cleavage site .

Meiosis : Events and mechanism –

Plasmodesmata== Structure, roll in movement of molecules and macromolecules, comparison with gap junctions.

Plant vacuoles- Tonoplast membrane, ATPases, transporters and storage organelles.

Chloroplasts- Structure, genome organisation, gene expression, RNA editing, nucleo-chloroplastic interaction.

Mitochondria- Structure, genome organisation, biogenesis.

Transport across cell membrane-

Major types of membrane transport, Active transport, Co-transport, symport, Autoport, Ion channels, Osmosis.

Macromolecular trafficking into and out of nucleus.

Protein Sorting – Transport of proteins into mitochondria and lysosomes

Vesicular traffic- coated and uncoated vesicles, transport of secretary materials, endocytosis

Cell cloning and its application

Genetic analysis in cell biology

MOLECULAR BIOLOGY

DNA Replication:- Replication in prokaryotes, replication fork, Replication in eukaryotes. D-Loop model of DNA, replication in single stranded DNA, rolling circle replication. DNA synthesis by reverse transcription

DNA Repair: Mismatch repair, base excision, nucleotide excision, direct repair, SOS-repair.

Prokaryotic transcription:- Mechanism of transcription, principle of gene regulation, The operon concept, lac and trp-operon, processing of t-RNA and r- RNA.

Eukaryotic transcription and regulation:

RNA polymerases: Structure and assembly, Eukaryotic promoters and enhancers,

General and specific transcription factors, transcriptional repressor. Mechanism of transcription regulation, gene silencing(transcriptional and post-transcriptional).

Modification in RNA:- 5' cap formation, transcription termination, 3'end processing and polyadenylation, splicing, editing, synthesis and processing of non-coding RNAs, Prokaryotic and eukaryotic translation.

The translation machinery, mechanism of initiation, elongation and termination Co and post – translation modification of proteins,

Cell signalling: Signalling and signal receptors, second messengers, G-Protein coupled receptors, activation of gene transcription by G-Protein coupled receptors.

Scope of genetic engineering –

Milestones in Genetic Engineering

Molecular tools :- Enzymes (Nucleases, restriction endonucleases) Phosphomonoesterases, alkaline phosphatases, polynucleotide kinase, DNA ligase, DNA polymerases, reverse transcriptase, terminal deoxynucleotidyltransferase, poly A polymerase) Hosts (E, Coli, yeast,

animal cells and plant cells) and Vectors (Plasmids, Bacteriophages, cosmids, ophagemids, and artificial chromosomes) Physio-Chemical Properties of nucleic acids, DNA double helical structure, types, structure and modifications, size, sequence and organization in chromatin. The types of RNA, mRNA synthesis, RNA dependent synthesis of DNA, Genetics Code Protein synthesis.

INSTRUMENTATION AND ANALYTICAL TECHNIQUE IN BIOLOGY

Microscopy :- Principles of working of light, Fluorescent and electron microscopes,, Microtomy.

Chromosome analysis:- Karyotyping and karyomorphometrical analysis, Taxidermy.

Centrifugation:-Principle of sedimentation, methods in preparatory ultracentrifugation (Differential and density gradient centrifugation)

Chromatography- Principle and application of exclusion Chromatography, Ion exchange Chromatography, Affinity Chromatography, Gas liquid Chromatography, HPLC (High pressure liquid chromatography)

Electrophoresis- Principle and application of electrophoretic separations, types of solid support used (Cellulose acetate, starch, agar, agarose and PAGE) and its importance. Isoelectric focussing.

Spectrophotometry: Principle and application of ultraviolet and visible spectrophotometry and sepectrofluorimetry.

X-ray diffraction crystallography, Radioactivity techniques: Nature of radioactivity, application of radioactivity in Biology (Carbondating, liquid scintillation counting, autoradiography)

BLOTTING TECHNIQUES (Southern, Northern, Western)

Computer application:- Introduction to digital computers, low-level and high –level languages, Binary number system, Flowchart and programming technique, Introduction to MS-Office software (word processing, spread sheds and presentation software), Introduction to internet and its applications.

BIOSTATISTICS:- Definition and scope of Biostatistics, Measurement of central tendency (Mean, median, mode), Measurement of dispersion, co-efficient of variation , Equationsfor linear and exponential relation , Elementary idea of probability, Normal poison, Binomial distribution, tests of significance (t and Chi-square tests) Simple correlation, sample techniques (Random Sampling etc) Analysis of variance (Simple factor design and their application in Zoology).

IMMUNOLOGY AND CANCER BIOLOGY

Phylogeny of immune system, Innate and acquired immunity, Hematopoiesis and differentiation, Cells of Immune system-B-lymphocytes, T-lymphocytes, Macrophages, Dendritic cells, Natural killer cells, Eosinophil's, Neutrophils and mast cells, Organization and structure of lymphoid organs, MALT, CALT, NALT, BALT ,Nature and biology of antigen and super antigens, structure and function of antibody molecule, Antigen-Antibody interaction (Antibody affinity, Radial and Double immunodiffusion, Radioimmunoassay, ELISA- Indirect, Direct, Sandwich, ELISPOT, Compentitive, Western blotting).

Major histocompatibility complex and MHC restriction, Antigen processing and presentation, Generation of humoral and cell mediated immune response, BCR and TCR, generation of diversity, Complement system (Classical Alternate and lectin pathway) Cytokines-Type and their role in immune regulations.

Activation and regulation of B and T lymphocytes, Cell-mediated cytotoxicity and Antibody dependent cell mediated cytotoxicity, Hypersensitivity, Auto-immunity and Transplantation.

Biology of cancer cell, Genetic basis of cancer: Proto-oncogenes, Viral and cellular oncogenes. Tumor suppressor genes.

Structure, function and mechanism of action of p^{RB} and p^{53} tumor suppressor proteins. Role of carcinogens and DNA repair in cancer.

DEVELOPMENTAL BIOLOGY

History of Developmental Biology (Contributions of Spemann, Hilde Mangold, Holtfreter, Needham, Waddington, Spratt, Briggs and King)

- 1) Gametogenesis
 - a) Spermatogenesis
 - b) OogenesisFertilization
 - a) Fertilization morphological aspects
 - b) Biochemical aspects of placentation

- 2) Embryonic adaptations
 - a) Placentation and implantation in mammals
 - b) Biochemical aspects of placentation

Organogenesis

- 3) a) Embryonic induction
- b) Movement of cells over long distance (Neural crest and primordial germ cells)
- 4) Growth: at cellular, intracellular and organismic levels and growth curves.
Regeneration in invertebrates and vertebrates. Role of nervous system in regeneration.
- 5) Metamorphosis
Biochemical aspects of metamorphosis in (insects and amphibians)
Nucleo-cytoplasmic interactions
Nuclear transplantation in vertebrate embryos
Homeotic genes and homeotic transformation in anuran tadpoles.

Adaptive Physiology: Adaptation: Mechanisms of adaptation, Physiological adaptations in different environments, Ecological factors (Temperature and light), Parasitic adaptation, Basis concept of environmental stress and strain: Stress resistance, stress avoidance and stress tolerance. Adaptation, Acclimation and Acclimatization, Concept of homeostasis, Physiological adaptation to osmotic and ionic stress, [Mechanism of cell volume regulation]

TAXONOMY, BIOSYSTEMATICS AND PALEOZOOLOGY

Definition and basic concepts of Biosystematics and Taxonomy. Importance and Applications of biosystematics in biology, Dimensions of speciation and taxonomic characters. Species concept Theories of biological classification, Hierarchy of categories.

Procedure keys in taxonomy, Taxonomic procedures: Taxonomic collections, preservation, curation, process of identification, International code of Zoological Nomenclature Formation of scientific names of various taxa.

Taxonomic publications: Strategy, Documentation, Kinds of publication, Major features and Preparation of manuscripts for publication.

Evaluation of biodiversity indices: Shannon-Winner Index, Dominance Index, Similarity and Dissimilarity Index.

Traditional taxonomy and newer trends in systematic

Chemo and serotaxonomy, Cytotaxonomy, Numerical taxonomy, Cladistics, Molecular systematic and DNA bar coding.

PALEONTOLOGY: Fossils and their significance: modes of fossilization, Study of morphology, range and broad classification of major invertebrate fossils, Introduction to micro fossils, Paleobotany, Origin of Jaws: The First sharks, Classa Acanthodii. The Spiny Skinhs, Achaeopteryx, Flightless Birds, Division Palaeognathae, Ice Age Extinction of Large Mammals. Survey of life through different geological era. Formation and types of fossils.

CHORDATES, EVOLUTION

Chordates

Affinities of Balanoglossus, Reproduction and colony formation in Urochordates, Amphioxus and its special status, Cyclostomes and their affinities,. Migration in fishes, Parental care and Luminous organin fishes, Air breathing fishes.

Evolution of Amphibia, Origin of Reptilia, Classification of reptiles.

Origin and Migration of birds, Plumage and colouration, Nesting habit in birds, Origin and early history of mammals, Systematic position of prototherians, Adaptive radiation in Marsupials, Evolution of primates(excluding man), Dentition in mammals.

Evolution

Evolutionary evidences and theories, Variation and selection as underlying mechanisms of evolution, Types and rates of mutation in population, Mechanism of isolation, Origin of species.

Evolutionary trends (micro, macro and mega patterns of evolution) Molecular and genomic evolution Gene flow, Gene duplication and mosaic evolution. Modes of speciation. Biological and cultural evolution of man.

ECOLOGY

ENVIRONMENTAL BIOLOGY

ECOSYSTEM:- Components, Energy sources and Energy flow in ecosystems, Food chains and food webs, Trophic levels, Biological Pyramids, Concepts of ecological niche, Ecological factors (temperature and light) Carbon and Nitrogen cycle.

ii) **RESOURCE BIOLOGY:-** Concept and classification of resources, Non-renewable Resources-Mineral resources, Renewable resources.

iii) **ECOLOGICAL SUCCESSION:-** Microbes in decomposition and recycling process, Aquatic biology, Physiochemical and biological properties of water, primary productivity. Waste utilization, Harmful effect of insecticides and pesticides. Biogas. Biomass. Solar energy. Coal wind mills, Concept of Habitat and Niche.

iv) **ENVIRONMENTAL POLLUTION:-**

- a) Air, Water, and Soil Pollution
- b) Solid Water Pollution
- c) Global Warming,
- d) Ozone layer depletion
- e) Hazardous wastes and Toxic chemicals Noise pollution, Acid rains and green house effect.



SYLLABUS FOR PSYCHOLOGY

Learning : Classical conditioning, Operant conditioning, observational learning, cognitive learning, theories: Tolman, Seligman and Kohler

Memory : Processes of memory Encoding, storage, Retrieval, models of memory, Stages of memory: sensory memory, STM, LTM. Forgetting : Theories, improving memory

Thinking : concepts, making decisions, problem solving, Reasoning, Creative thinking.

Perception: (b) Pattern Recognition, Visual Pattern Recognition, Bottom- Up versus Top- Down processing, Template Matching, Feature Analysis, Prototype Matching, The role of the perceiver in pattern recognition

Attention:(a) Nature of attention, Bottleneck theories of attention, Filter theory, Attenuation theory and late selection theory

(b) Alternative to filter theories – Capacity models, demanding stimuli, and automaticity.

Emotion : Theories of emotion and physiological changes during emotion

Personality: Theories of personality, Psycho-analytic-Freudian, Neo-Freudian, Modern Psychoanalytic theory, Behaviouristic, Humanistic

Intelligence: Artificial intelligence, Theories of intelligence, Spearman, Gardner, Sternberg, Nature Vs. Nurture, Mental retarded-ness, Giftedness

Physiology :Structure and function of neuron, structure and function of Central Nervous system: Brain and spinal cord, structure and function of Autonomic Nervous system, endocrine system, Methods of studying brain functions and cerebral localisations

Concept of cognitive Psychology: Origin and current status of modern cognitive psychology. Cognitive models, and the computer metaphor and human cognition

Neuro-recognition: Cognitive Psychology and Neuroscience, the nervous system- the neuron. the brain- anatomy of the brain, neuro-physiological sensing techniques, relationship between the left and right hemispheres.

Perception: (a) Perception of sensory signals, Sensation and Perception, Signal Detection Theory, Perceptual span, Iconic and Echoic Storage, Functions of Sensory stores.

Life Span Perspective on Heredity and Environment: Genetics of Life Span Development and Environmental Influences, The working of Individual heredity, Studying Genetic and Environmental influences- Genes, environment and individual differences in traits.

(a) Development of Perceptual Processes: during Infancy, Childhood, Adolescence, and Adulthood.

(b) Development of Intelligence, Creativity and Wisdom.

Development of Learning and Memory: during infancy, childhood, adolescence and adulthood.

Development of Self and Personality: Theories of personality development (Freud and Erickson), Development of Personality through infancy, childhood, adolescence and adulthood, and development of the emotional self.

Statistics: Normal Probability Curve, Characteristics and Applications, Logic of Hypothesis Testing, Type I and Type II Errors, Power of Statistical Tests.

(b) 't' test, product moment correlation and simple regression.

(a) One way and Two way ANOVA, Randomized block design

(b) Multiple Comparisons - (Newman – Keuls, Tukey test, scheffe test, Duncan's Multiple Range Test.)

Rank order correlation, Sign test, Median test, Chi-square test.

Mann – Whitney ‘U’ test, Kruskal – Wallis One way ANOVA, Friedman’s Two – way ANOVA.

Perspectives of Social Psychology: Cognitive, multicultural, biological and evolutionary

(a) **Attribution:** Understanding the causes of other’s behaviour.

(b) **Impression formations and management:** Combining and managing social information, basic aspects of social thought.

Attitude: Attitude Formation & Development; Change of Attitude, and Attitude Measurement.

Interpersonal Attraction: Interpersonal Attraction and Liking; Attachment and Interdependent Relationships

Prejudice and discrimination: (a) Definition and nature of prejudice and discrimination, how they differ, Origin of Prejudice, Prejudice based on gender- its nature & effect; (b) Countering, reducing and coping with prejudice.

Current paradigms on Psychopathology: Biological, Psychoanalytic, humanistic, and existential, learning and cognitive

Stress- clinical reaction to stress, adjustment disorder, acute stress disorder, Dissociative disorder, treating stress related problems

Personality disorder: Eccentric behaviour, Paranoid, and schizoid personality disorder, Histrionics and narcissistic disorder, anti-social behaviour, Treatment of personality disorder anxiety disorder,

Applying Social Psychology to media and criminal justice: Introduction, How does media violence affect us? Does political news coverage affect us? The crime and criminal – The social psychology of crime, the origin of criminal behaviour, the response to the criminal-justice system, - the police investigation, the courtroom and the prison setting.

SYLLABUS FOR COMPUTER SCIENCE

1. FUNDAMENTALS OF COMPUTER HARDWARE AND MULTIMEDIA

Fundamentals of computers Hardware and accessories – development of hard disk, physical construction, CHS(Cylindrical Head Sector) and LBA(Logical Block Addressing) addressing, Master Boot Record, Primary and Extended partition Tables. Memory and processor.

Multimedia: multimedia data (Audio, video, image, text) representation, Multimedia compressions. Methods of storing multimedia data.

2. DATA/FILE STRUCTURES & ALGORITHMS

Data, Information, Definition of data structure, Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps.

File Structures: Fields, records and files, Sequential, direct, index-sequential and relative files, Hashing, inverted lists and multi-lists, B trees and B⁺ trees.

Algorithms: Asymptotic analysis, Searching and Sorting, Amortized Analysis, Advanced Data structure, Dynamic Programming, Greedy Algorithm.

3. COMPUTER ORGANIZATION&OPERATING SYSTEMS

Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices (PLDs), Programmable Array Logic (PAL), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Array (FPGA), Basic Machine Instruction Types, Addressing Mode, Memory System, Internal Organization of Memory Chips, Read-Only Memories, Secondary Storage.

Main functions of operating systems, Multiprogramming, Multiprocessing, and Multitasking.

Memory Management: Virtual Memory, Paging, Fragmentation.

Concurrent Processing: Mutual exclusion, Critical regions, lock and unlock.

Scheduling: CPU scheduling, I/O scheduling, Resource scheduling, Deadlock and scheduling algorithms, Banker's algorithm for deadlock handling.

4. DATABASES & COMPUTER NETWORKS

ER diagrams and their transformation to relational design, normalization – 1NF, 2NF, 3NF, BCNF, 4NF. Limitations of 4NF and BCNF.

SQL: Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands, Database objects like – Views, indexes, sequences, synonyms, data dictionary.

Network fundamentals: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks. Reference Models: The OSI model, TCP/IP model.

Data link control: Channel capacity, Transmission media - twisted pair, coaxial cables, fiber-optic cables, wireless transmission – radio, microwave, infrared and millimeter waves, Light wave transmission, Telephones – local loop, trunks, multiplexing, switching, narrowband ISDN, broadband ISDN, ATM, High speed LANS, Cellular Radio, Communication satellites - geosynchronous and low-orbit, Switch/Hub, Bridge, Error detection and correction, Flow control. Internetworking: Router, Gateways, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls. Routing: Virtual circuits and datagrams, Routing, Congestion control and avoidance, TCP Congestion management policy.

Protocols of network applications:, Domain Name System (DNS) - Electronic Mail and World Wide Web (WWW), The DNS, Resource Records, Name servers, E-mail-architecture and Servers, Web server, HTTP, SHTTP

5. CRYPTOGRAPHY: Data Encryption and decryption methods. Private and public key cryptosystem, digital signature (RSA and Hash based signature)

