ಸಿಎಸ್ಐಆರ್ - ಕೇಂದ್ರೀಯ ಆಹಾರ ತಂತ್ರಜ್ಞಾನ ಸಂಶೋಧನಾಲಯ, ಮೈಸೂರು - 570 020, ಭಾರತ
सीएसआईआर – केंद्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूरु - 570 020, भारत
CSIR - Central Food Technological Research Institute, Mysuru - 570 020, India

FT/15(1182)/2021/E-I

24th October, 2024

NOTIFICATION

Sub: Recruitment for the post of Technical Assistant– reg.
Ref: 1. CSIR-CFTRI Advertisement No. Rec.36/2018
2. CSIR-CFTRI Web Notifications dated 25/03/2021 & 24/08/2021

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Kind attention of the candidates, who had applied for various post(s) of Technical Assistant vide advertisement cited under Ref. (1) above and the list of shortlisted candidates to appear for Trade Test vide notification cited under Ref. (2).

This is for the information of all concerned that the syllabus for Trade Test and Written Test (Paper-III) for the post of Technical Assistant notified vide Advt. No. Rec.36/2018 is hereby notified as Annexure.

Other details i.e. date, time, venue, admit cards etc. of Trade Test to be held in near future (at Mysuru), will be made available on our website and will be informed through e-mail to the candidates in due course.

It is to be noted that at the time of attending the trade test, the shortlisted candidates for Post Codes TA-06, TA-08 & TA-09 should select one of the subjects specified against the post code in the advertisement where more than one subject is mentioned as an essential qualification. The subject so chosen by the candidate should be one of the subject(s) mentioned in their Mark sheet/Certificate of essential educational qualification i.e. B.Sc.

Further, the candidate need to submit an option form at the time of attending the trade test and the subject chosen in the option form will be final and irrevocable i.e. binding upon the candidate. Candidate will be allowed to appear for the trade test in the subject chosen in the option form only.

Those who qualify in the Trade Test will be invited for a competitive written examination and the candidate will be considered for selection only based on the prescribed subject chosen in the option form at the time of trade test for that particular post. Hence, the candidates shall carefully select the subject paper at the time of attending the Trade Test.

Meanwhile the shortlisted candidates may keep the following Original Documents ready, which will be required at the time of Document Verification:

- 10th/ Matriculation or Equivalent Certificate for Age Proof.
- All Educational Qualifications along with Mark Sheets
- All experience certificates, as proof of experience. (If applicable)
- Latest/Valid Community or Category certificates etc., as per GoI central format, in case of SC/ST/OBC(NCL)/PwBD/Women (Widows/Divorced/Judicially Separated) categories, if claimed.
- Any other document in support of the claim made in the application, as applicable

DATES REGARDING THE TRADE TEST SHALL BE HOSTED ON THE WEBSITE IN DUE COURSE AND SHORTLISTED CANDIDATES ARE ADVISED TO CHECK THEIR REGISTERED EMAILS AS WELL AS CSIR-CFTRI WEBSITE https://cftri.res.in REGULARLY FOR THE UPDATES. NO INTERIM OR TELEPHONIC ENQUIRY OR CORRESPONDENCE WILL BE ATTENDED TO.

Sd/-
Controller of Administration

Selection Procedure for Technical Assistant/Group-III (1)

The candidates as recommended by the Screening Committee will be invited for Trade Test. Those who qualify in the Trade Test will be invited for a competitive written examination. The final merit list will be prepared on the basis of the performance of the candidate in the competitive written examination.

The syllabus of written test for Technical Assistant: -

There will be three papers. The second and third paper will be evaluated only for those candidates who secure the minimum threshold mark (to be determined by the selection committee) in the first paper.

Mode of examination	OMR/Computer Based Objective Type Multiple Choice Examination.
Medium of Questions	The questions will be set both in English and Hindi except the questions on English language.
Total No. of Questions	200
Total Time Allotted	3 hours

Paper-I (Time Allotted- 1 hour)

Subject	No. of Questions	Maximum Marks	Negative Marks
Mental Ability Test*	50	100 (two marks for every correct answer)	There will be no negative marks in this paper.

* Mental Ability Test will be so devised so as to include General intelligence, Quantitative Aptitude, Reasoning, Problem Solving, Situational judgment, etc.

Paper-II (Time Allotted- 30 Minutes)

Subject	No. of Questions	Maximum Marks	Negative Marks
General Awareness	25	75 (Three marks for every correct answer)	One negative mark for every wrong answer
English Language	25	75 (Three marks for every correct answer)	One negative mark for every wrong answer

Paper-III (Time Allotted- 90 Minutes)

Subject	No. of Questions	Maximum Marks	Negative Marks
Concerned Subject	100	300 (Three marks for every correct answer)	One negative mark for every wrong answer

Advertisement No.36/2018

Post Code: TA-01 **Area: Food Technology & Food Science**

Food Composition and Nutrition
Moisture in foods and methods of moisture determination.
Carbohydrate, protein, and fat content in foods and changes during processing. Vitamins and minerals in foods and changes during processing
Plant pigments in foods and changes during processing
Energy value of foods, energy requirement.
Nutritional aspects of carbohydrates, proteins, and fats.
Nutritional significance of vitamins and minerals and deficiency diseases. Recommended Daily Allowances for nutrients and balanced diets.

Food Microbiology and safety
Microorganisms: Types and growth requirements
Physical, chemical and biological factors influencing the destruction of microorganisms Micro-organisms in food products
Sources and prevention of contamination.
Microbiology of various foods: water, milk and milk products; cereals and cereal products; fruits, vegetables and their products; meat and meat products; fish and fish products; poultry and eggs

Food Processing and packaging
Basic principles of food processing
Causes for food spoilage.
Refrigerated, Modified and controlled atmosphere storage
Food preservation techniques: Freezing, Drying and dehydration, use of salt and sugars, Chemical preservation, Food irradiation, Hurdle technology
Processing of fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.
Package materials and functions: Papers and paper-boards, plastic films, aluminium foils, metallised films, bags, pouches, wraps, corrugated fibre-board boxes, wooden containers, sacks and folding cartons. Tin plate, aluminium and composite cans. Glass containers
Packaging of fresh fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.

Plant Management, cost accounting and storage procedures
Regulatory requirements of food industries.
Structure and operation of food plants.
Computer applications, database, operating systems, networking, and project management.
Industrial cost accounting, purchase procedure, stores procedure, materials accounting, overheads, budget and budgetary control, and product costing.

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Post Code: TA-02 **Area: Microbiology**

Introduction to Microbiology and Microbial Diversity
Diversity of Microbial World- Systems of classification & General characteristics, An overview of Scope of Microbiology. Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology, Development of the field of soil microbiology

Bacteriology
Cell organization, Bacteriological techniques (culture media, sterilization, isolation methods, staining, preservation) Microscopy, Growth and nutrition, Reproduction in Bacteria, Bacterial Systematics, Important archaeal and eubacterial groups.

Fungi
General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexualmechanism.

Algae
General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespot food reserves and vegetative, asexual andsexual reproduction

Protozoa
General characteristics with special reference to Amoeba, Paramecium and Plasmodium

Biochemistry
Bioenergetics, Proteins, DNA, RNA, Carbohydrates, Lipids, Enzymes, Vitamins.

Virology
Nature and Properties of Viruses, Bacteriophages, Viral Transmission, Salient features of viral nucleic acids and Replication, Viruses and Cancer, Prevention & control of viral diseases and Applications of Virology

Microbial Physiology and Metabolism
Microbial Growth and Effect of Environment on Microbial Growth, Nutrient uptake and Transport, Chemoheterotrophic Metabolism - Aerobic Respiration, Chemoheterotrophic Metabolism-Anaerobic respiration and fermentation, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism – an overview.

Cell Biology
Structure and organization of Cell, Nucleus, Protein Sorting and Transport, Cell Signalling, Cell Cycle, Cell Death and Cell Renewal.

Molecular Biology
Structures of DNA and RNA / Genetic Material, Replication of DNA (Prokaryotes and Eukaryotes), Transcription in Prokaryotes and Eukaryotes, Post- Transcriptional Processing, Translation (Prokaryotes and Eukaryotes), Regulation of gene Expression in Prokaryotes and Eukaryotes.

Microbial Genetics
Genome Organization and Mutations, Plasmids, Mechanisms of Genetic Exchange, Phage Genetics, Transposable elements.

Environmental Microbiology
Microorganisms and their habitats, Microbial Interactions, Biogeochemical Cycling, Waste Management, Microbial Bioremediation, Water Potability.

Food and Dairy Microbiology
Foods as a substrate for microorganisms, Microbial spoilage of various foods, Principles and methods of food preservation, Fermented foods, Food borne diseases ((causative agents, foods involved, symptoms and preventive measures)), Food sanitation and control, Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology

Industrial Microbiology
Introduction to industrial microbiology, Isolation of industrially important microbial strains and fermentation media, Types of fermentation processes, bio- reactors and measurement of fermentation parameters, Down-stream processing, Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and uses), Enzyme immobilization.

Immunology
Immune Cells and Organs, Antigens, Antibodies, Major Histocompatibility Complex, Complement System, Generation of Immune Response, Immunological Techniques.

Medical Microbiology
Normal microflora of the human body and host pathogen interaction, Bacterial diseases, Viral diseases, Protozoan diseases, Fungal diseases, Antimicrobial agents: General characteristics and mode of action

Bioinformatics
Introduction to Computer Fundamentals, Introduction to Bioinformatics and Biological Databases, Sequence Alignments, Phylogeny and Phylogenetic trees, Genome organization and analysis and Protein Structure Predictions

Plant Pathology
Introduction and History of plant pathology, Stages in development of a disease, Plant disease epidemiology, Host Pathogen Interaction, Control of Plant Diseases, Specific Plant diseases Study of some important plant diseases giving emphasis on its etiological agent,symptoms, epidemiology and control

Biostatistics
Measures of central tendency, Measures of dispersion; skewness, kurtosis; Elementary Probability and basic laws; Discrete and Continuous Random variable, Mathematical Expectation; Curve Fitting; Correlation and Regression. Emphasis on examples from Biological Sciences; Mean and Variance of Discrete and Continuous Distributions namely Binomial, Poisson, Geometric, Weibull, Logistic and Normal distribution. Fitting of Distributions; Statistical methods: Scope of statistics: utility and misuse. Principles of statistical analysis of biological data. Sampling parameters. Difference between sample and Population, Sampling Errors, Censoring, difference

between parametric and non-parametric statistics; Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom; Large Sample Test based on Normal Distribution, Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test - Chi-square test;

Microbial Biotechnology
Microbial Biotechnology and its Applications, Therapeutic and Industrial Biotechnology, Applications of Microbes in Biotransformations, Microbial Products and their Recovery, Microbes for Bio-energy and Environment, RNAi and Intellectual Property Rights

Advances in Microbiology
Evolution of Microbial Genomes, Metagenomics, Molecular Basis of Host-Microbe Interactions and Systems and Synthetic Biology

Instrumentation and Biotechniques
Microscopy, Chromatography, Electrophoresis, Spectrophotometry and Centrifugation

Recombinant DNA Technology and Cloning Vectors
Definition and Properties of Plasmid vectors, Transformation of DNA, DNA Amplification and DNA sequencing, PCR: Basics of PCR, RT-PCR, Real-Time qPCR, Sanger's method of DNA Sequencing: traditional and automated sequencing, Southern - and Northern - blotting techniques, dot blot, DNA microarray, SDS-PAGE and Western blotting, Construction and Screening of Genomic and cDNA libraries. And Applications of Recombinant DNA Technology.

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Post Code: TA-03 **Area: Maths, Physics, Chemistry**

Physics

Mechanics

Fundamentals of Dynamics, Work and Energy, Collisions, Rotational Dynamics, Elasticity, Fluid Motion, Gravitation and Central Force Motion, Oscillations, Non-Inertial Systems, Special Theory of Relativity

Electricity & Magnetism

Electric Field and Electric Potential, Dielectric Properties of Matter, Magnetic Field, Magnetic Properties of Matter, Electromagnetic Induction, Electrical Circuits, Network Theorems.

Waves & Optics

Superposition of Collinear Harmonic Oscillations, Superposition of Two Perpendicular Harmonic Oscillations, Wave Motion, Superposition of Two Harmonic Waves, Wave _ Optics, Interference, Interferometer Diffraction, Fraunhofer Diffraction, Holography, Polarization, Lens System, Aberrations, Resolving Power of Telescope and Microscope

Thermal Physics

Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic Relations, Kinetic Theory of Gases, Distribution of Velocities, Molecular Collisions, Real Gases.

Elements of Modern Physics

Quantum Theory and Blackbody Radiation, Uncertainty and Wave-Particle Duality, Schrodinger Equation, One-dimensional Box and Step Barrier, Structure of the Atomic Nucleus, Radioactivity, Detection of nuclear radiation, Fission and Fusion Lasers.

Analog Systems & Applications

PN junction diode, Principle and Structure of (a) LEDs (b)Photodiode (c) Solar Cell, Bipolar Junction Transistors, Amplifiers, Coupled Amplifier, Feedback in Amplifiers, Sinusoidal Oscillators, Operational Amplifiers (Black Box approach), Applications of Op-Amps.

Quantum Mechanics & Applications:

Time Dependent Schrodinger Equation, Time Independent Schrodinger Equation, Bound States, Hydrogen-like Atoms, Atoms in Electric & Magnetic Fields, Many Electron Atoms.

Solid State Physics
Crystal Structure, Elementary Lattice Dynamics, Magnetic Properties of Matter, Dielectric Properties of Materials, Ferroelectric Properties of Materials, Free Electron Theory of Metals, Superconductivity.

Electromagnetic Theory
Maxwell Equations, EM Wave Propagation in Unbounded Media, EM Wave in Bounded Media, Poynting Theorem, Optical Fibres, Structure, pulse dispersion & modes of propagation

Statistical Mechanics
Classical Statistics, Classical Theory of Radiation, Quantum Theory of Radiation, Bose-Einstein Statistics, Fermi-Dirac Statistics.

Instrumentation
CRO and applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency and Phase Difference, Power Supply: Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Multimeter.

Chemistry

Inorganic Chemistry
Atomic Structure, Periodicity of Elements, Chemical Bonding, Oxidation-Reduction, General Principles of Metallurgy, Acids and Bases, Chemistry of s and p Block Elements, Noble gases, Inorganic Polymers, Coordination Chemistry, Transition Elements, Bioinorganic Chemistry, Coordination Chemistry, Transition Elements, Bioinorganic Chemistry, Organometallic compounds.

Physical Chemistry
Gaseous state, Liquid state, Solid state, Ionic equilibria, Chemical Thermodynamics, Systems of Variable Composition, Chemical Equilibrium, Solutions and Colligative Properties, Phase Equilibria, Chemical Kinetics, Catalysis, Surface chemistry, Conductance, Electrochemistry, Electrical & Magnetic Properties of Atoms and Molecules, Quantum Chemistry, Molecular Spectroscopy and Fundamentals of Magnetic Resonance Spectroscopy.

Organic Chemistry
Basic Organic Chemistry, Stereochemistry, Chemistry of Aliphatic Hydrocarbons, Cycloalkanes and Conformational analysis, Aromatic Hydrocarbons, Chemistry of Halogenated Hydrocarbons, Alcohols, Phenols, Ethers and Epoxides, Carbonyl Compounds, Carboxylic Acids and their Derivatives, Nitrogen Containing Functional Groups, Polynuclear Aromatic Hydrocarbons, Nucleic Acids, Amino Acids, Peptides and Proteins, Enzymes, Lipids.

Mathematics

Calculus

Higher order derivatives, Leibnitz rule and its applications to problems, concavity and inflection points, asymptotes, L'Hopital's rule, Applications of differential calculus, Reduction formulae, derivations and illustrations of reduction formulae, volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Multiple integrals, Theorems of integration and applications.

Vectors

introduction to vector functions, operations with vector-valued functions

Complex Numbers

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Complex differentiation, complex integration.

Mathematical Logical, Functions, Sets, Fields, Rings and group theory

Statements and logic, statements with quantifier, compound statements, implications, proofs in Mathematic; Sets, operations on sets, family of sets, power sets, Cartesian product, Functions, one-one, onto functions and bijections, Composition of functions, Inverse of a function, Image and Inverse image of subsets; Relation, Equivalence relations, Equivalence classes and partitions of a set, congruence modulo n in integers, Induction Principles, the well-ordering principle, greatest common divisor of integers. Definition of fields, groups, rings and representations and related lemma and theorems.

Matrices & Determinants

Systems of Linear Equations, row reduction and echelon forms, vector equations, the matrix equation Ax =b, solution sets of linear systems, linear independence, introduction to linear transformations, the matrix of a linear transformation, Matrix operations, inverse of a matrix, characterizations of invertible matrices, Determinants,

Real Analysis

Algebraic and order properties of R, absolute value and real line, bounded sets, supremum and infimum, completeness property of R, the Archimedean property, intervals, nested interval theorem. Real sequences, limit of a sequence, convergent sequence, bounded sequence, limit theorems, monotone sequences, monotone convergence theorem, Infinite series, convergence and divergence of infinite series, Cauchy criterion, Tests for convergence, comparison test, limit comparison test, ratio test, root test, integral test, alternating series, Leibniz test,

Differential Equations

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Linear Algebra

Vector spaces and subspaces, null space and column space of a matrix, linear transformations, kernel and range, linearly independent sets, bases, coordinate systems,

dimension of a vector space, rank, change of basis. Eigen vectors and eigen values of a matrix, the characteristic equation, diagonalization, eigen vectors of a linear transformation, complex eigen values, lnvariant subspaces and Cayley-Hamilton theorem. Inner product, length, and orthogonality, orthogonal sets, orthogonal projections, the Gram-Schmidt process, inner product spaces; Diagonalization of symmetric matrices,

Partial Differential Equations:

Introduction, Classification, Construction of first order partial differential equations (PDE). Cauchy's problem for first order equations, linear equations of the first order, Integral surfaces passing through a given curve, Nonlinear partial differential equations of the first order, Cauchy's method of characteristics, Charpit's method. Canonical form of first order PDE, Method of separation of variables for first order PDE. Reduction to canonical forms, Equations with constant coefficients, General solution.

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Post Code: TA-04 **Area: Food Technology & Food Science**

Food Composition and Nutrition
Moisture in foods and methods of moisture determination.
Carbohydrate, protein, and fat content in foods and changes during processing. Vitamins and minerals in foods and changes during processing
Plant pigments in foods and changes during processing
Energy value of foods, energy requirement.
Nutritional aspects of carbohydrates, proteins, and fats.
Nutritional significance of vitamins and minerals and deficiency diseases. Recommended Daily Allowances for nutrients and balanced diets.

Food Microbiology and safety
Microorganisms: Types and growth requirements
Physical, chemical and biological factors influencing the destruction of microorganisms Micro-organisms in food products
Sources and prevention of contamination.
Microbiology of various foods: water, milk and milk products; cereals and cereal products; fruits, vegetables and their products; meat and meat products; fish and fish products; poultry and eggs

Food Processing and packaging
Basic principles of food processing
Causes for food spoilage.
Refrigerated, Modified and controlled atmosphere storage
Food preservation techniques: Freezing, Drying and dehydration, use of salt and sugars, Chemical preservation, Food irradiation, Hurdle technology
Processing of fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.
Package materials and functions: Papers and paper-boards, plastic films, aluminium foils, metallised films, bags, pouches, wraps, corrugated fibre-board boxes, wooden containers, sacks and folding cartons. Tin plate, aluminium and composite cans. Glass containers
Packaging of fresh fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.

Plant Management, cost accounting and storage procedures
Regulatory requirements of food industries.
Structure and operation of food plants.
Computer applications, database, operating systems, networking, and project management.
Industrial cost accounting, purchase procedure, stores procedure, materials accounting, overheads, budget and budgetary control, and product costing.

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Post Code: TA-5 **Area: Mechanical Engineering**

- Engineering Drawing: Geometrical constructions, lettering, scales, projection of points, projection of lines, orthographic projection, rivet heads and joints, isometric projection, screwed fastenings,

- Machine Drawing: Cutting Geometric Solids with Planes, Keys, Cotter joints and Pin Joints, Pipe drawings, Welded Joints, Shaft Coupling, Shaft bearings arid brackets, Pulleys, Valves, Engine Parts, Auto CAD, 2D & 3D models

- Engineering Mechanics: coplanar concurrent forces, moments, coplanar non-concurrent forces, center of gravity, moment of inertia, friction, motion, work, power and energy, simple lifting machines.

- Fluid Mechanics & Fluid Machines: Definition & classification of fluid, physical properties of fluids, fluid measurements, Introduction to fluid power systems, components of Hydraulic systems, Hydraulic Circuits, Components of pneumatic systems, Pneumatic Circuits, pipe & open channel flow, fluid machines, hydraulic turbines, pumps, Centrifugal pumps, Reciprocating pumps.

- Manufacturing Technology: Basic Machine Tools, Metal Casting Process, Forming Heat treatment, Arc Welding, Gas Welding, Advanced Welding Processes and safety measures, Press Work, Powder Metallurgy, Cutting Fluids and Coolants, Lathe operations, Drilling machine, Shaper, Planer & Slotter, Grinding & Surface finishing, Milling machine, Non-Traditional machining methods, Jigs and Fixtures, Theory of metal cutting, Drilling Machine & abrasive process, Broaching, CNC machining, Computer integrated manufacturing (CIM, CAM), power tools, sheet metal work, fitting and carpentry

- Refrigeration & Air-conditioning working & applications, Refrigeration cycles, controlling components, components required for Refrigeration system, Air conditioning

- Thermodynamics: Fundamentals and laws of Thermodynamics, Laws of perfect gases, Fuels and Combustion, Air standard cycles, Properties of steam.

- Engineering Materials: Mechanical properties of materials, Classification and their properties, Metal Casting, Moulding, Patterns, Metal Working, Metal Forming, Machine Tools and Machining Processes, Lathe Machine and types, Lathe Operations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Drilling Machine Operations, Grinding Machine Operations, Failure analysis & Testing of Materials, Corrosion & Surface Engineering, structure of Solids, crystal structure, ferrous metals and it's alloys, non-ferrous metals and it's alloys, plastic, testing of materials, heat treatment, Engineering Materials and Joints

- Theory of Machines & Mechanisms: Theory of Machine, Basic kinematics of Machines, Friction, Transmission of Power, Cams, Mechanical Vibrations, Balancing, Governors, Design of Bearings & Spur Gears, Power Transmission: Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications, Timer belt and timer pulleys; Velocity Ratio, Chain Drives – Advantages & Disadvantages; Gear Drives – Spur gear

terminology; Types of gears and gear trains, their selection for different applications; simple epicyclic gear train; Rope Drives – Types & applications

- Thermal Engineering: Steam generators, Steam nozzles, Steam turbine, Steam condensers and Cooling towers, Nuclear power plant, Internal Combustion Engine, Air compressors, Gas turbine and propulsion, Refrigeration Cycle, Fuels & combustion of fuels and performance of I.C Engines, Plant Safety.

- Heat Transfer: Conduction, Convection, Radiation, Heat exchangers

- Measurements and Metrology: Basic concepts of measurements - Introduction, precision and accuracy, linear and angular measurements, measurement of screw threads, Errors in Measurements, measurement of gears, advances in metrology - laser metrology, computer in metrology, Measurement of mechanical parameters - force, measurement of power, measurement of flow, Comparators: Characteristics and Types, Surface finish, surface roughness tester, Transducers and Strain gauges, micrometer, bevel protractor.

- Advance Workshop Practice & CNC Machine: Safety and security measures inside the tool room, manual part programming, Computer Aided Machine Drawing: Introduction, CNC Programming and Machining, CNC Turning Machine, CNC Milling Machine, Machine Tool Automation, ATC, Tool magazine, Principles of computer aided part programming, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Special purpose machines and machine tool maintenance

- Estimating & Costing: Elements of costs, Indirect expenses and depreciation, Mensuration and Estimation of material cost, Estimation of Machining Time, Estimation of Welding & Fabrication Time, Sheet metal, Modern machining processes, Jigs and Fixtures

- Environmental Science: Air and noise pollution, water and soil pollution, Renewable source of energy, Solid waste management, ISO 14001 & Environmental management

- Basic engineering material and their properties, identification, threading's and their identification

ಸಿಎಸ್ಐಆರ್ - ಕೇಂದ್ರೀಯ ಆಹಾರ ತಂತ್ರಜ್ಞಾನ ಸಂಶೋಧನಾಲಯ, ಮೈಸೂರು - 570 020, ಭಾರತ
सीएसआईआर – केंद्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूरु - 570 020, भारत
CSIR - Central Food Technological Research Institute, Mysuru - 570 020, India

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Post Code: TA-06 **Area: Biochemistry / Chemistry**

(I) Syllabus for Biochemistry

Molecules of Life
Foundations of biochemistry - Cellular and chemical foundations of life, water unique properties - weak interactions in aqueous systems, Carbohydrates and Glycobiology, Lipids, Amino acids, Nucleic acids, Vitamins.

Cell Biology
Introduction to cell biology - Prokaryotic (archaea and eubacteria) and eukaryotic cell, Tools of cell biology, Structure of different cell organelles, Cytoskeletal proteins, Cell wall and extracellular matrix, Cell cycle, cell death and cell renewal, CRISPR, fluorescence microscopy and flow cytometry.

Proteins
Introduction to amino acids, peptides and proteins, Extraction of proteins for downstream processing, Separation techniques, Characterization of proteins, Three-dimensional structures of proteins, Protein folding, X-ray crystallography, NMR Spectroscopy, Cryo-electron microscopy.

Enzymes
Introduction to enzymes, Features of enzyme catalysis, Enzyme kinetics, Bisubstrate reactions, Enzyme inhibition, Mechanism of action of enzymes, Applications of enzymes, Allosteric regulation and enzyme cofactors/ coenzymes.

Metabolism of Carbohydrates and Lipids
Basic design of metabolism, Glycolysis, Gluconeogenesis and pentose phosphate pathway, Glycogen metabolism, Citric acid cycle, Synthesis of carbohydrates, Fatty acid oxidation, Fatty acid synthesis. Lipid metabolism disorders and regulatory mechanisms of metabolism.

Membrane Biology and Bioenergetics
Introduction to biomembranes - Composition of biomembranes, Membrane structures, Membrane dynamics, Membrane transport, Vesicular transport and membrane fusion, bioenergetics, Oxidative phosphorylation, Photophosphorylation.

Hormone
Biochemistry and Function: Introduction to endocrinology - Functions of hormones and their regulation.

Human Physiology
Homeostasis and the organization of body fluid compartments, Cardiovascular physiology, Respiration, Renal physiology, Gastrointestinal and hepatic physiology, Musculoskeletal system, Reproductive physiology, Neurophysiology.

Gene Organization, Replication and Repair
Structure of DNA, Genes and genomic organization, Replication of DNA, Recombination and transposition of DNA, Molecular basis of mutations, Various modes of DNA repair, Modem techniques in DNA sequencing and analysis.

Metabolism of Amino Acids and Nucleotides
Overview of amino acid metabolism, Catabolism of amino acids, Biosynthesis of amino acids, Precursor functions of amino acids, Biosynthesis of purine and pyrimidine nucleotides, Disorders related to amino acid metabolism.

Concepts in Genetics
Introduction to model organisms and Mendelism, Applications of Mendel's principles & chromosomal basis of heredity, Extensions of Mendelism, Genetic definition of a gene, Genetics of bacteria and viruses, Linkage, crossing over and mapping techniques, Human pedigree analysis, The genetic control of development and sex determination, Organelle heredity and epigenetics, Chromosomal aberrations, Inheritance of complex traits & population genetics, Evolutionary genetics. CRISPR-Cas-9 and other genome editing techniques.

Gene Expression and Regulation
Biosynthesis of RNA in prokaryotes, Biosynthesis of RNA in eukaryotes, RNA splicing, The genetic code, Biosynthesis of proteins, Protein targeting and degradation, Regulation of gene expression in prokaryotes, Regulation of gene expression in eukaryotes. Epigenetic modifications and RNA interference.

Genetic Engineering and Biotechnology
Introduction to recombinant DNA technology, Cloning vectors for prokaryotes and eukaryotes, Joining of DNA fragments, Introduction of DNA into cells and selection for recombinants, Methods for clone identification, Polymerase chain reaction, DNA sequencing, Expression of cloned genes, Applications of genetic engineering in Biotechnology, Gene Therapy, Transgenic organisms and Biopharmaceuticals.

II. Syllabus for Chemistry

Basic Concepts of Chemistry (Organic, Inorganic and Physical Chemistry)
Importance and scope of chemistry, Laws of chemical combination, concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage composition, empirical and molecular formula, chemical reactions.
Organic Chemistry: IUPAC nomenclature

Structure of Atom
Atomic number, isotopes and isobars, concept of shells and subshells, dual nature of matter and light, concept of orbital, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

Classification of Elements and Periodicity in Properties
Periodic table: s, p, d and f-Block Elements: Modern periodic law and long form of the periodic table, periodic trends in properties of elements based upon electronic configuration, atomic radii, ionic radii, valence, Diagonal relationship, inert pair effect, atomic and ionic radii, ionization energy.

Molecular Structure and Chemical Bonding
Electrovalent, covalent and Coordination Compounds: Valence electrons, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules. Weak Interactions: Hydrogen bonding, van der Waals forces. Hybridization, bond length, bond energy, bond angle, localised and delocalized pi-bonds, resonance, inductive effect and shapes of molecules and ions. Aromaticity.

States of Matter
Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, Boyle's law, Charle's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Liquid State-Vapour pressure, viscosity and surface tension.

Thermodynamics
First, Second and Third law of Thermodynamics and Chemical Kinetics, Rate of a reaction (average and instantaneous), factors affecting rates of reaction.

Redox Reactions
Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.

Equilibrium
Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, ionic equilibrium-ionization of acids and bases, strong and weak electrolytes, degree of ionization, acid strength, concept of pH, Hydrolysis of salts (elementary idea), buffer solutions.

Chemical Kinetics
Concentration, temperature, order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions), Method of determination of order of reaction.

Hydrocarbons
Alkanes, Alkenes, Alkynes, Alcohols, Aldehydes, Ketones, Carboxylic Acids, Phenols and Ethers (stereochemistry), Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions, Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.

Biomolecules
Carbohydrates- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.
Proteins- Elementary idea of - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.
Hormones- lementary idea (excluding structure), Vitamins- Classification and function, Nucleic Acids: DNA and RNA.

Polymers
Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers like polyesters, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Surface Chemistry:
Adsorption-physisorption and chemisorption, factors affecting adsorption of gases on solids catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- types of emulsions. concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation, catalyst.

General Principles and Processes of Isolation of Elements
Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron. Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.

Chromatography
Principle and application of TLC and paper Chromatography

Spectroscopy
Principle, instrumentation and application of IR, UV

Environmental Chemistry
Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants, acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Chemistry in Everyday Life
Chemicals in medicines-analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
Chemicals in food-preservatives, artificial sweetening agents, elementary idea of antioxidants.
Cleansing agents- soaps and detergents, cleansing action.

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Post Code: TA-07 **Area: Horticulture**

Major fruit, vegetable, plantation, spices, medicinal and aromatic crops of tropical, subtropical and temperate regions; Nutritive value of fruits and vegetables and their role in human nutrition

Importance of post-harvest technology in horticulture crops, present status and future scope; Post-harvest losses and factors responsible for deterioration of horticulture produce; Maturity indices, physiological and biochemical changes during ripening process, hastening and delaying of ripening process; Pre and post-harvest treatments for extending storage life; Estimation of PLW, TSS, titratable acidity, ascorbic acid; Post harvest treatment of horticulture produce - hot water treatment, waxing, growth regulators, calcium compounds and fungicides; Cold storage of fruits and vegetables; Storage disorders and spoilages in horticulture produce; Browning reactions in fruits and vegetables; Importance, present status and future scope of fruit and vegetable processing/preservation industry in India

General principles of preservation of horticulture produce; Principles and methods of drying and dehydration; Preservation by heating, by use of sugar, chemicals, salt, spices, essential oils and vinegar; Preservation by fermentation and freezing; Minimal processing of fruits and vegetables; Packaging of processed horticultural products; Spoilages in processed horticultural products; Quality control of processed products and food laws, Government policies on import and export of processed horticulture produce; Principles and guidelines for the establishment of processing industry; Study of tools and equipment used in processing of horticulture produce; Preparation of dried and dehydrated products; Raisin preparation; Preparation of juice, RTS, nectar, cordial, squash, syrup, jam, jelly, candied and crystallized products, tomato ketchup and sauce, pickles; Canning of fruits and vegetables; spoilage in canned products; Mushroom cultivation, processing and product development.

Importance and scope of landscape architecture; Functional uses of plants for landscape; Steps in preparation of garden design; Special types of gardens (rock, water, marsh/ bog, sunken, shade, roof, terrace, vertical, instant, dish, traffic island and terrarium); Landscaping for specific areas; Xeriscaping definition, principles and practice; Garden equipment; Study and designing of different styles of gardens; Study and designing of gardens based on different themes; Designing gardens for specific place; Basic elements of garden design viz., major and minor elements; Styles (formal and informal) and types of garden (english, japanese, mughal, french, persian and italian gardens); Garden features/components (garden wall, gates, fence, paths and drives, steps, bridges, hedge, edge, borders, flower beds, carpet bed, lawn, arches and pergolas, terraces); Garden adornments (garden seats/benches, tubs/ urns/ vases, lanterns, statutes, sculptures, fountains, water basins, bird bath, floral clock, sun dials); Famous gardens of India

Importance, classification, design values and cultivation tips for ornamental plants viz. annuals, biennales, herbaceous perennials, bulbous ornamentals, shrubs, trees, climbers, palms and cycads, ferns, cacti, succulents and indoor plants; Establishment of lawn and its maintenance; Bonsai culture and its maintenance; Nursery practices for raising annuals and potted ornamentals; Major pests and diseases of garden plants and their management.

ಸಿಎಸ್ಐಆರ್ - ಕೇಂದ್ರೀಯ ಆಹಾರ ತಂತ್ರಜ್ಞಾನ ಸಂಶೋಧನಾಲಯ, ಮೈಸೂರು - 570 020, ಭಾರತ
सीएसआईआर – केंद्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूरु - 570 020, भारत
CSIR - Central Food Technological Research Institute, Mysuru - 570 020, India

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Post Code: TA-08 **Area: Food Science & Food Technology/ Biotechnology**

(I) Syllabus for Food Science & Food Technology

Food Composition and Nutrition

Moisture in foods and methods of moisture determination.
Carbohydrate, protein, and fat content in foods and changes during processing. Vitamins and minerals in foods and changes during processing
Plant pigments in foods and changes during processing
Energy value of foods, energy requirement.
Nutritional aspects of carbohydrates, proteins, and fats.
Nutritional significance of vitamins and minerals and deficiency diseases. Recommended Daily Allowances for nutrients and balanced diets.

Food Microbiology and safety

Microorganisms: Types and growth requirements
Physical, chemical and biological factors influencing the destruction of microorganisms Microorganisms in food products
Sources and prevention of contamination.
Microbiology of various foods: water, milk and milk products; cereals and cereal products; fruits, vegetables and their products; meat and meat products; fish and fish products; poultry and eggs

Food Processing and packaging

Basic principles of food processing
Causes for food spoilage.
Refrigerated, Modified and controlled atmosphere storage
Food preservation techniques: Freezing, Drying and dehydration, use of salt and sugars, Chemical preservation, Food irradiation, Hurdle technology
Processing of fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.
Package materials and functions: Papers and paper-boards, plastic films, aluminium foils, metalised films, bags, pouches, wraps, corrugated fibre-board boxes, wooden containers, sacks and folding cartons. Tin plate, aluminium and composite cans. Glass containers
Packaging of fresh fruits and vegetables, cereals, pulses, millets, oilseeds, meat, fish, poultry and dairy products.

Plant Management, cost accounting and storage procedures

Regulatory requirements of food industries.
Structure and operation of food plants.
Computer applications, database, operating systems, networking, and project management.
Industrial cost accounting, purchase procedure, stores procedure, materials accounting, overheads, budget and budgetary control, and product costing.

II. Syllabus for Biotechnology

Biochemistry & Metabolism
Introduction to Biochemistry, Lipids: Structure and functions-Classification, Carbohydrates Metabolism, Bioenergetics and thermodynamics.

Cell Biology
Cell, Introduction and classification of organisms by cell structure, cell division and cell cycle, Membrane Vacuolar system, Lysosomes: Vacuoles and microbodies, Nucleus: Structure and function, chromosomes and their structure, Extracellular Matrix: Composition.

Principles of Immunology
Development, function, and control of immune system cells; immunoglobulins; cytokines; immunological mechanisms involved in infectious disease immunity; autoimmunity; hypersensitivity; and transplantation and tumour immunology, monoclonal antibodies, ELISA & other Immunological Techniques

Plant Anatomy & Physiology
Anatomy, Plant water relations and micro macronutrients, Carbon and nitrogen metabolism, Growth and development, Biodiversity Taxonomy and Tissue Culture.
Genetics: Introduction, Historical developments in the field of genetics, Non-allelic interactions, Chromosome and gene mutations, Genetic linkage.

General Microbiology
Functional morphology of the microbial cell, Microbial nutrition, Microbial growth, Physical and chemical control of microorganisms.

Molecular Biology
DNA structure and replication, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation.
Biophysical Chemistry: Structure of proteins, DNA, RNA and enzymes.
Bioprocess Technology: Introduction to bioprocess technology-Techniques and basic principle components, Introduction to oxygen requirement in bioprocess, Introduction to downstream processing.

Recombinant DNA Technology
Molecular tools and applications: vectors, restriction enzymes, ligases, polymerases, alkaline phosphatase, Restriction and modification system, restriction mapping, Random and site-directed mutagenesis, Genetic engineering in plants, Screening of recombinants, applications of rDNA technology.
Bio-Analytical Tools: Microscopy, Spectroscopy, Chromatography, Electrophoresis, Molecular Techniques.
Genomics & Proteomics: Introduction to Genomics, DNA sequencing methods, Managing and Distributing Genome Data, Introduction to protein structure, Chemical properties of proteins, Introduction to Proteomics, Analysis of Proteomes.

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Post Code: TA-09 **Area: Microbiology / Chemistry / Biochemistry**

(I) Syllabus for Microbiology

Introduction to Microbiology and Microbial Diversity
Diversity of Microbial World- Systems of classification & General characteristics, An overview of Scope of Microbiology. Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology, Development of the field of soil microbiology

Bacteriology
Cell organization, Bacteriological techniques (culture media, sterilization, isolation methods, staining, preservation) Microscopy, Growth and nutrition, Reproduction in Bacteria, Bacterial Systematics, Important archaeal and eubacterial groups.

Fungi
General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexualmechanism.

Algae
General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespot food reserves and vegetative, asexual andsexual reproduction

Protozoa
General characteristics with special reference to Amoeba, Paramecium and Plasmodium

Biochemistry
Bioenergetics, Proteins, DNA, RNA, Carbohydrates, Lipids, Enzymes, Vitamins.

Virology
Nature and Properties of Viruses, Bacteriophages, Viral Transmission, Salient features of viral nucleic acids and Replication, Viruses and Cancer, Prevention & control of viral diseases and Applications of Virology

Microbial Physiology and Metabolism
Microbial Growth and Effect of Environment on Microbial Growth, Nutrient uptake and Transport, Chemoheterotrophic Metabolism - Aerobic Respiration, Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism – an overview.

Cell Biology
Structure and organization of Cell, Nucleus, Protein Sorting and Transport, Cell Signalling, Cell Cycle, Cell Death and Cell Renewal.

Molecular Biology
Structures of DNA and RNA / Genetic Material, Replication of DNA (Prokaryotes and Eukaryotes), Transcription in Prokaryotes and Eukaryotes, Post- Transcriptional Processing, Translation (Prokaryotes and Eukaryotes), Regulation of gene Expression in Prokaryotes and Eukaryotes.

Microbial Genetics
Genome Organization and Mutations, Plasmids, Mechanisms of Genetic Exchange, Phage Genetics, Transposable elements.

Environmental Microbiology
Microorganisms and their habitats, Microbial Interactions, Biogeochemical Cycling, Waste Management, Microbial Bioremediation, Water Potability.

Food and Dairy Microbiology
Foods as a substrate for microorganisms, Microbial spoilage of various foods, Principles and methods of food preservation, Fermented foods, Food borne diseases ((causative agents, foods involved, symptoms and preventive measures)), Food sanitation and control, Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology

Industrial Microbiology
Introduction to industrial microbiology, Isolation of industrially important microbial strains and fermentation media, Types of fermentation processes, bio- reactors and measurement of fermentation parameters, Down-stream processing, Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and uses), Enzyme immobilization.

Immunology
Immune Cells and Organs, Antigens, Antibodies, Major Histocompatibility Complex, Complement System, Generation of Immune Response, Immunological Techniques.

Medical Microbiology
Normal microflora of the human body and host pathogen interaction, Bacterial diseases, Viral diseases, Protozoan diseases, Fungal diseases, Antimicrobial agents: General characteristics and mode of action

Bioinformatics
Introduction to Computer Fundamentals, Introduction to Bioinformatics and Biological Databases, Sequence Alignments, Phylogeny and Phylogenetic trees, Genome organization and analysis and Protein Structure Predictions

Plant Pathology
Introduction and History of plant pathology, Stages in development of a disease, Plant disease epidemiology, Host Pathogen Interaction, Control of Plant Diseases, Specific Plant diseases Study of some important plant diseases giving emphasis on its etiological agent,symptoms, epidemiology and control

Biostatistics
Measures of central tendency, Measures of dispersion; skewness, kurtosis; Elementary Probability and basic laws; Discrete and Continuous Random variable, Mathematical Expectation; Curve Fitting; Correlation and Regression. Emphasis on examples from Biological Sciences; Mean and Variance of Discrete and Continuous Distributions namely Binomial, Poisson, Geometric, Weibull, Logistic and Normal distribution. Fitting of Distributions; Statistical methods: Scope of statistics: utility and misuse. Principles of statistical analysis of biological data. Sampling parameters. Difference between sample and Population, Sampling Errors, Censoring, difference

between parametric and non-parametric statistics; Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom; Large Sample Test based on Normal Distribution, Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test - Chi-square test;

Microbial Biotechnology
Microbial Biotechnology and its Applications, Therapeutic and Industrial Biotechnology, Applications of Microbes in Biotransformations, Microbial Products and their Recovery, Microbes for Bio-energy and Environment, RNAi and Intellectual Property Rights

Advances in Microbiology
Evolution of Microbial Genomes, Metagenomics, Molecular Basis of Host-Microbe Interactions and Systems and Synthetic Biology

Instrumentation and Biotechniques
Microscopy, Chromatography, Electrophoresis, Spectrophotometry and Centrifugation

Recombinant DNA Technology and Cloning Vectors
Definition and Properties of Plasmid vectors, Transformation of DNA, DNA Amplification and DNA sequencing, PCR: Basics of PCR, RT-PCR, Real-Time qPCR, Sanger's method of DNA Sequencing: traditional and automated sequencing, Southern - and Northern - blotting techniques, dot blot, DNA microarray, SDS-PAGE and Western blotting, Construction and Screening of Genomic and cDNA libraries. And Applications of Recombinant DNA Technology.

(II) Syllabus for Biochemistry

Molecules of Life
Foundations of biochemistry - Cellular and chemical foundations of life, water unique properties - weak interactions in aqueous systems, Carbohydrates and Glycobiology, Lipids, Amino acids, Nucleic acids, Vitamins.

Cell Biology
Introduction to cell biology - Prokaryotic (archaea and eubacteria) and eukaryotic cell, Tools of cell biology, Structure of different cell organelles, Cytoskeletal proteins, Cell wall and extracellular matrix, Cell cycle, cell death and cell renewal, CRISPR, fluorescence microscopy and flow cytometry.

Proteins
Introduction to amino acids, peptides and proteins, Extraction of proteins for downstream processing, Separation techniques, Characterization of proteins, Three-dimensional structures of proteins, Protein folding, X-ray crystallography, NMR Spectroscopy, Cryo-electron microscopy.

Enzymes
Introduction to enzymes, Features of enzyme catalysis, Enzyme kinetics, Bisubstrate reactions, Enzyme inhibition, Mechanism of action of enzymes, Applications of enzymes, Allosteric regulation and enzyme cofactors/ coenzymes.

Metabolism of Carbohydrates and Lipids
Basic design of metabolism, Glycolysis, Gluconeogenesis and pentose phosphate pathway, Glycogen metabolism, Citric acid cycle, Synthesis of carbohydrates, Fatty acid oxidation, Fatty acid synthesis. Lipid metabolism disorders and regulatory mechanisms of metabolism.

Membrane Biology and Bioenergetics
Introduction to biomembranes - Composition of biomembranes, Membrane structures, Membrane dynamics, Membrane transport, Vesicular transport and membrane fusion, bioenergetics, Oxidative phosphorylation, Photophosphorylation.

Hormone
Biochemistry and Function: Introduction to endocrinology - Functions of hormones and their regulation.

Human Physiology
Homeostasis and the organization of body fluid compartments, Cardiovascular physiology, Respiration, Renal physiology, Gastrointestinal and hepatic physiology, Musculoskeletal system, Reproductive physiology, Neurophysiology.

Gene Organization, Replication and Repair
Structure of DNA, Genes and genomic organization, Replication of DNA, Recombination and transposition of DNA, Molecular basis of mutations, Various modes of DNA repair, Modem techniques in DNA sequencing and analysis.

Metabolism of Amino Acids and Nucleotides
Overview of amino acid metabolism, Catabolism of amino acids, Biosynthesis of amino acids, Precursor functions of amino acids, Biosynthesis of purine and pyrimidine nucleotides, Disorders related to amino acid metabolism.

Concepts in Genetics
Introduction to model organisms and Mendelism, Applications of Mendel's principles & chromosomal basis of heredity, Extensions of Mendelism, Genetic definition of a gene, Genetics of bacteria and viruses, Linkage, crossing over and mapping techniques, Human pedigree analysis, The genetic control of development and sex determination, Organelle heredity and epigenetics, Chromosomal aberrations, Inheritance of complex traits & population genetics, Evolutionary genetics. CRISPR-Cas-9 and other genome editing techniques.

Gene Expression and Regulation
Biosynthesis of RNA in prokaryotes, Biosynthesis of RNA in eukaryotes, RNA splicing, The genetic code, Biosynthesis of proteins, Protein targeting and degradation, Regulation of gene expression in prokaryotes, Regulation of gene expression in eukaryotes. Epigenetic modifications and RNA interference.

Genetic Engineering and Biotechnology
Introduction to recombinant DNA technology, Cloning vectors for prokaryotes and eukaryotes, Joining of DNA fragments, Introduction of DNA into cells and selection for recombinants, Methods for clone identification, Polymerase chain reaction, DNA sequencing, Expression of cloned genes, Applications of genetic engineering in Biotechnology, Gene Therapy, Transgenic organisms and Biopharmaceuticals.

II. Syllabus for Chemistry

Basic Concepts of Chemistry (Organic, Inorganic and Physical Chemistry)
Importance and scope of chemistry, Laws of chemical combination, concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage composition, empirical and molecular formula, chemical reactions.
Organic Chemistry: IUPAC nomenclature

Structure of Atom
Atomic number, isotopes and isobars, concept of shells and subshells, dual nature of matter and light, concept of orbital, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

Classification of Elements and Periodicity in Properties
Periodic table: s, p, d and f-Block Elements: Modern periodic law and long form of the periodic table, periodic trends in properties of elements based upon electronic configuration, atomic radii, ionic radii, valence, Diagonal relationship, inert pair effect, atomic and ionic radii, ionization energy.

Molecular Structure and Chemical Bonding
Electrovalent, covalent and Coordination Compounds: Valence electrons, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules. Weak Interactions: Hydrogen bonding, van der Waals forces. Hybridization, bond length, bond energy, bond angle, localised and delocalized pi-bonds, resonance, inductive effect and shapes of molecules and ions. Aromaticity.

States of Matter
Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, Boyle's law, Charle's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Liquid State-Vapour pressure, viscosity and surface tension.

Thermodynamics
First, Second and Third law of Thermodynamics and Chemical Kinetics, Rate of a reaction (average and instantaneous), factors affecting rates of reaction.

Redox Reactions
Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.

Equilibrium
Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, ionic equilibrium-ionization of acids and bases, strong and weak electrolytes, degree of ionization, acid strength, concept of pH, Hydrolysis of salts (elementary idea), buffer solutions.

Chemical Kinetics
Concentration, temperature, order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions), Method of determination of order of reaction.

Hydrocarbons
Alkanes, Alkenes, Alkynes, Alcohols, Aldehydes, Ketones, Carboxylic Acids, Phenols and Ethers (stereochemistry), Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions, Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.

Biomolecules
Carbohydrates-Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.
Proteins-Elementary idea of - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.
Hormones- Elementary idea (excluding structure), Vitamins- Classification and function, Nucleic Acids: DNA and RNA.

Polymers
Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers like polyesters, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Surface Chemistry
Adsorption-physisorption and chemisorption, factors affecting adsorption of gases on solids catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- types of emulsions. concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation, catalyst.

General Principles and Processes of Isolation of Elements
Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron. Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.

Chromatography
Principle and application of TLC and paper Chromatography

Spectroscopy
Principle, instrumentation and application of IR, UV

Environmental Chemistry
Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants, acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Chemistry in Everyday Life
Chemicals in medicines-analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
Chemicals in food-preservatives, artificial sweetening agents, elementary idea of antioxidants.
Cleansing agents- soaps and detergents, cleansing action.

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Post Code: TA-10 **Area: Chemical Engineering/ Technology**

Inorganic Chemistry
Basics of nucleon and the structure of an atom and periodic properties of elements. Types of hardness and removal of hardness. Oxidation reaction, redox reactions

Physical and Organic Chemistry
- Basics of Thermo Chemistry: Enthalpy, endothermic/exothermic reactions.
- Order of reaction, Zero, first order, second order, fractional order reaction.
- Classification of Protein, sources, composition, Qualitative analysis of Carbohydrates and Protein

Momentum Transfer
Fluid states – fluids definition, properties of fluids, classification of fluids, pressure-types and measuring device, boundary layer, Fluid flow phenomena- types of flow, energies of fluids-Bernoulli's equation, Mass flow rate & volumetric flow rate, average velocity, continuity equation, Flow of incompressible fluids, pressure drop, energy loss, drag co-efficient, pipes, fittings and valves, Transportation of fluids, pumps-classification of pumps, fans, blowers & compressors:

Mechanical Operations
Size reduction - methods of size reduction, size reduction equipment, characterization of solid particles-screening, screening equipment, Sedimentation-settling, centrifugation, filtration-types and equipment, separation of solid particles-mechanical classifier, gravity concentration, special separation techniques, froth flotation, gas-solid separation, agitation and mixing-impellers, propeller, paddles & turbines, swirling & vortex, concept of mixing index-power number, industrial mixers.

Heat Transfer
Modes of heat transfer, conduction- fourier's law of conduction, conduction through composite wall, hollow cylinder composite cylinders, thermal conductivity, thermal diffusivity, analogy between heat conduction & electrical current flow, Types of Convection, sieder - date equation & dittus boelter equation, different modes of condensation, boiling mechanism, dimensionless, numbers, Radiation- stephen boltzmann law & kirchhoffs law, Heat Exchangers- logarithmic mean temperature difference (LMTD), types of heat exchangers, construction & working principle of heat exchanger, Evaporation- principles of evaporation, types of evaporator, multiple effect evaporation and thermal insulation.

Chemical Process Calculations
Basics of process calculation, behaviour of ideal gases, gaseous mixtures, vapour pressure: Material balance without chemical reaction distillation, evaporation, leaching and drying, bypass operation- recycle operation, purging operation (Brief descriptions only), Material balance with chemical reactions stoichiometric ratio, limiting reactant, excess reactant, combustion: Energy balance Enthalpy changes accompanying chemical reaction.

Chemical Engineering Thermodynamics and Reaction Engineering
Terminologies in Thermodynamics, properties of a system- first law of thermodynamics, ideal gas equation of state, Second Law of Thermodynamics- Carnot cycle, Third law of Thermodynamics, fugacity & fugacity co-efficient activity, Chemical kinetics-rate law, rate constant, fractional conversion, effect of temperature on reaction rate, integral method analysis for irreversible first order reaction and second order reaction, chemical equilibrium and equilibrium constant, Chemical reactors- classification of chemical reactors, Concept of

Space time and space velocity, comparison of batch reactor, Continuous Stirred Tank Reactor (CSTR) and Plug Flow Tubular Reactor (PFTR), Catalyst-homogenous and heterogeneous catalyst, Preparation of Solid Catalyst, Catalyst deactivation.

Mass Transfer I & II

Fick's laws, molecular diffusion in fluids, mass transfer coefficient Absorption- Principles of absorption, equilibrium curve and operating line for absorption, concepts of minimum Gas, Liquid ratio, Construction and principle of operation of packed bed absorption column Operating problems, HTU, NTU and HETP concepts, Humidification Operation-Terminology used in humidification operation, Equipment for Humidification- Cooling tower, Distillation-Rayleigh's equation, flash distillation vacuum distillation, continuous multistage rectification, McCabe Thiele method, Overall efficiency and Murphree plate efficiency, Azeotropic distillation , Extractive distillation , Steam distillation, Principles of Drying terminologies used in drying, types of drying, Crystallization- supersaturation, Crystallisation equipment, Liquid-liquid extraction, Distribution coefficient and selectivity, Extraction equipments, Principles of Leaching- Shanks extraction battery process for leaching, Equipments for Leaching, Adsorption- industrial applications of adsorption, Adsorption equipment, desorption, adsorbent regeneration

Process instrumentation and control

Purpose of Instrumentation — Instrumentation diagram, Temperature measuring Instruments, Temperature Transmitter, Pressure-Methods of pressure measurement, Vacuum measurement Differential Pressure Transmitter, Flow measurement, Liquid level measurement, Humidity measurement: Terminology used in the control system, process control system, block diagram, elements of process control, automatic controller's, Control application in liquid level system, Heat exchanger, Batch Reactor: Computerized process control, Transmission of analog signal, electronic and pneumatic methods, Process control computers, Distributed Controlled System(DCS), simple control flow sheets using computer for Batch reactor and CSTR

Chemical Technology

Sources of water, characteristics of water, caustic embrittlement, Water softening methods demineralization of water, Boiler feed water, deareation, Manufacture of Soda ash by Solvay process manufacture of chlorine, manufacture of caustic soda, Manufacture of oxygen from air by liquefaction, Production of oil from plant seeds, hydrogenation of vegetable oils, Manufacture of soap by full boiled process- recovery and purification of glycerine, Manufacture of pulp by Krafi process- manufacture of paper from pulp, Polymers, types of polymerisation, bulk polymerisation, solution polymerisation and emulsion polymerisation.

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Post Code: TA-11 **Area: Electrical & Electronics Engineering**

Principle of Electrical Engineering
Concept of current, voltage, resistance; Magnetism and Electromagnetism, Electromagnetic Induction, Energy Conversion Principle, Electrostatic, AC Fundamentals, Phasor Algebra.

Elements of Electronic and Devices
Semiconductors, Electronic devices, Transistor, Transistor amplifier, Feedback circuit and oscillator, Special semiconducting devices, Integrated circuits.

Element of Mechanical Engineering
Sources of power, prime movers, Properties and laws of gases, Properties of steam, Generation of steam, Steam engine, Internal combustion engine, Steam Turbines, Gas Turbines, Transmission of motion and power.

Electrical Circuit & Network
D.C Network Theorem (With independent Source), D.C Network Theorem (With dependent Source), A.C Network Theorem, Single phase AC parallel circuit, Three phase circuit, Transients, Application of Mat lab.

Electrical measurement and measuring instruments
Unit, dimensions and Standards, Measurement and instrumentation system, Electromechanical instruments, Measurement of resistance, Potentiometer, A.C. Bridge, Measurement of current and voltage, Measurement of power, Measurement of energy, Instruments for special purpose, Electronics Instrument, Primary sensing, Element and transducer, Data transmission and telemetry, Microprocessor based Instrumentation system.

Electrical machine
D.C. Generator, D.C. Motor, Single Phase Transformer, Three Phase Transformer, Special D.C. machine, Special Transformer, Poly phase induction motor, Single phase induction motor, Alternators Synchronous motor, Commutator motor Special, Commutator motor, Special A.C. machine.

Electrical Engineering Materials
Conducting Materials, Semiconducting Material, Insulating Materials, Dielectric Material, Magnetic Material, Electric Hardware, Constructional Materials.

Electrical & Electronics Drawing and Design
Symbols and Notation, Electrical Machine Drawing, Winding, Electrical Wiring, Sub-Station, Electronic Drafting, Transformer Design.

Digital Electronics
Number System, Logic gates, Boolean algebra, Combinational logic, Flip-Flops, Register and Counters, Data Converter & Memory Devices, Display Construction.

Control system
Automatic control system, Laplace Transform, Transfer function, Block diagram, Control system component, Time Domain analysis, Stability analysis.

Electrical Power
Generation of Electrical Power, Economics of Generation and Economic Load Dispatch, Transmission of Electrical Power, Mechanical Design of Transmission Line, HVDC Transmission, Substation, Power System Stability, PLC.

Non-conventional energy
Non-Conventional Energy Sources, Solar Energy Engineering, Wind Energy Engineering, Ocean Energy Engineering, Geothermal Energy Engineering, Bio Energy Engineering, Direct Energy Conversion Systems, Chemical Energy Sources.

AC Distribution and Utilization
AC Distribution, SCADA System for Electrical Distribution, Power Factor Improvement, Electrical Tariff, Cables, Electric Heating and Welding, Electric Drives, Electro Chemical Power.

Switchgear and Protection
Elements of Protection, Relays, Neutral Earthing, Circuit Interrupting Devices, Arc Formation Process, Circuit Breaker, Protection Scheme, Over Voltage Protection.

Installation and maintenance of electrical equipment
Tools and Accessories, Installation, Commissioning Test, Earthing Necessity, Testing and maintenance of insulation, Types of maintenance, Troubleshooting, Electrical accidents and safety measures.

ಸಿಎಸ್ಐಆರ್ - ಕೇಂದ್ರೀಯ ಆಹಾರ ತಂತ್ರಜ್ಞಾನ ಸಂಶೋಧನಾಲಯ, ಮೈಸೂರು - 570 020, ಭಾರತ
सीएसआईआर – केंद्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूरु - 570 020, भारत
CSIR - Central Food Technological Research Institute, Mysuru - 570 020, India

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Post Code: TA-12 **Area: Library & Information Science**

Foundations of Library & Information Science
Development of libraries, Role of Libraries in Society, Laws of Library Science, Types of libraries. Librarianship as a Profession, Library Legislation, Library co-operation & Resource sharing, Professional Associations: National & International Associations

Reference Service & Information Sources
Reference Service, Types of Reference Service, Organization & Management of Reference Department, reference sources. Study and evaluation of reference sources, Reference Questions, User Education.

Information Science
Documentation and Information Science, Sources of Information, Information & information needs of users, Information Transfer: Communication of Information. Information services, Information Systems & Information Networks and Centers.

Knowledge Organization
Classification, Universe of Knowledge-Structure and attribute, Normative Principles of Classification & their application. Species of classification schemes, Standard schemes of classification and their features, Colon Classification, Dewey Decimal Classification and Universal Decimal Classification, Trends in classification. Information storage and retrieval, Indexing (Pre and Post Co-ordinate)

Resource Description
Parts of a book, Library catalogue and its forms, Catalogue Entries, Normative Principles of Cataloguing. Principles and practices of document description, Standardization in description and bibliographic exchange, Subject cataloguing, Bibliographic control, Co-operation and Centralization in Cataloguing, Metadata Standards and Protocols: MARC-21, Z-39.50, Dublin Core etc.

Information Technology Application in Libraries and Information Centres
Introduction and Communication Technology, Computer Application to Libraries & Information Centers, Networking and Internet, Library Automation, Plagiarism Detection Tools, High performance scanner, Printers, RFID, Barcode Technology. Innovative Library Services by using technology

Library Management
Management of Collection and Resources, Collection maintenance, HRM & Financial management, Reporting. Audit: Accession Register, Asset Abstract Register (AAR), Issue-Return Register, Visitor Register. User Orientation Program, Library Security: CCTV Camera, Security Guard, Close access, Pest Control, and other Physical Security measures, Binding of Loose Journals, Books, Documents, Thesis, Research Reports, Project Reports etc. Physical Stock Verification and Weeding out of Obsolete Publications

Library Automation and Digitization
Library Automation software: Koha, Libsys, Egranthalaya, Digital Library Software: Dspace, Eprint, Greenstone

Digital Information Resources

E-Journals Consortiums, Resource sharing, Digital Object Identifier (DOI), Patent Databases, Standards, E-books, ISSN/ISBN/RNI, Study and evolution of reference sources and web resources

Scientometrics and Bibliometrics

Citation Analysis of Research & Development papers published, Indicators of Research Evaluation, Impact Factor, H-Index, i10 Index, Bibliometric Databases: Web of Science, Scopus etc.

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Post Code: TA-14 **Area: Mechanical Engineering**

- Engineering Drawing: Geometrical constructions, lettering, scales, projection of points, projection of lines, orthographic projection, rivet heads and joints, isometric projection, screwed fastenings,

- Machine Drawing: Cutting Geometric Solids with Planes, Keys, Cotter joints and Pin Joints, Pipe drawings, Welded Joints, Shaft Coupling, Shaft bearings arid brackets, Pulleys, Valves, Engine Parts, Auto CAD, 2D & 3D models

- Engineering Mechanics: coplanar concurrent forces, moments, coplanar non-concurrent forces, center of gravity, moment of inertia, friction, motion, work, power and energy, simple lifting machines.

- Fluid Mechanics & Fluid Machines: Definition & classification of fluid, physical properties of fluids, fluid measurements, Introduction to fluid power systems, components of Hydraulic systems, Hydraulic Circuits, Components of pneumatic systems, Pneumatic Circuits, pipe & open channel flow, fluid machines, hydraulic turbines, pumps, Centrifugal pumps, Reciprocating pumps.

- Manufacturing Technology: Basic Machine Tools, Metal Casting Process, Forming Heat treatment, Arc Welding, Gas Welding, Advanced Welding Processes and safety measures, Press Work, Powder Metallurgy, Cutting Fluids and Coolants, Lathe operations, Drilling machine, Shaper, Planer & Slotter, Grinding & Surface finishing, Milling machine, Non-Traditional machining methods, Jigs and Fixtures, Theory of metal cutting, Drilling Machine & abrasive process, Broaching, CNC machining, Computer integrated manufacturing (CIM, CAM), power tools, sheet metal work, fitting and carpentry

- Refrigeration & Air-conditioning working & applications, Refrigeration cycles, controlling components, components required for Refrigeration system, Air conditioning

- Thermodynamics: Fundamentals and laws of Thermodynamics, Laws of perfect gases, Fuels and Combustion, Air standard cycles, Properties of steam.

- Engineering Materials: Mechanical properties of materials, Classification and their properties, Metal Casting, Moulding, Patterns, Metal Working, Metal Forming, Machine Tools and Machining Processes, Lathe Machine and types, Lathe Operations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Drilling Machine Operations, Grinding Machine Operations, Failure analysis & Testing of Materials, Corrosion & Surface Engineering, structure of Solids, crystal structure, ferrous metals and it's alloys, non-ferrous metals and it's alloys, plastic, testing of materials, heat treatment, Engineering Materials and Joints

- Theory of Machines & Mechanisms: Theory of Machine, Basic kinematics of Machines, Friction, Transmission of Power, Cams, Mechanical Vibrations, Balancing, Governors, Design of Bearings & Spur Gears, Power Transmission: Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications,

Timer belt and timer pulleys; Velocity Ratio, Chain Drives – Advantages & Disadvantages; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; simple epicyclic gear train; Rope Drives – Types & applications

- Thermal Engineering: Steam generators, Steam nozzles, Steam turbine, Steam condensers and Cooling towers, Nuclear power plant, Internal Combustion Engine, Air compressors, Gas turbine and propulsion, Refrigeration Cycle, Fuels & combustion of fuels and performance of I.C Engines, Plant Safety.

- Heat Transfer: Conduction, Convection, Radiation, Heat exchangers

- Measurements and Metrology: Basic concepts of measurements - Introduction, precision and accuracy, linear and angular measurements, measurement of screw threads, Errors in Measurements, measurement of gears, advances in metrology - laser metrology, computer in metrology, Measurement of mechanical parameters - force, measurement of power, measurement of flow, Comparators: Characteristics and Types, Surface finish, surface roughness tester, Transducers and Strain gauges, micrometer, bevel protractor.

- Advance Workshop Practice & CNC Machine: Safety and security measures inside the tool room, manual part programming, Computer Aided Machine Drawing: Introduction, CNC Programming and Machining, CNC Turning Machine, CNC Milling Machine, Machine Tool Automation, ATC, Tool magazine, Principles of computer aided part programming, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Special purpose machines and machine tool maintenance

- Estimating & Costing: Elements of costs, Indirect expenses and depreciation, Mensuration and Estimation of material cost, Estimation of Machining Time, Estimation of Welding & Fabrication Time, Sheet metal, Modern machining processes, Jigs and Fixtures

- Environmental Science: Air and noise pollution, water and soil pollution, Renewable source of energy, Solid waste management, ISO 14001 & Environmental management

- Basic engineering material and their properties, identification, threading’s and their identification