



**Syllabus for Paper -III Test for the post of Technical Assistant, Post Code : TA1 Area:
Chemical Sciences against Advt. No: IITR/1/2024.**

Chemical Sciences

1. **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
2. **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.
3. **Classification of Elements and Periodicity in Properties:**
 - Periodic table: s, p, d and f-Block Elements: Modern periodic law and long form of 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 and ionization energy.
4. **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.
5. **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.

6. **Thermodynamics:**
- First, Second and Third law of Thermodynamics and Chemical Kinetics, Rate of a reaction (average and instantaneous), factors affecting rates of reaction.
7. **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.
8. **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.
9. **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.
10. **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.
11. **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
12. **Polymers:**
- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization.

- Some important polymers like polyesters, Bakelite, rubber, Biodegradable and non-biodegradable polymers.

13. 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, lyophilic, 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, Arrhenius equation, catalyst.

14. 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.

15. Chromatography:

- Principle, theory, instrumentation and application

16. Spectroscopy:

- Principle, theory, instrumentation and application

17. Environmental Chemistry:

- Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smog, 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.

18. 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.

Syllabus for Trade Test

1. Volumetric Analysis

- Determination of acetic acid in commercial vinegar using NaOH
- Determination of alkali content - antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry
- Estimation of hardness of water by EDTA
- Estimation of ferrous ions by dichromate method
- Estimation of copper using thiosulphate.
- Preparation of standard solutions related to normality and molarity.
- Determination of the strength of given unknown oxalic acid solution by titrating it against Potassium permanganate.

2. pH determination

- Measurement of pH of different solutions using pH-meter.
- Preparation of buffer solutions
 - Sodium acetate-acetic acid
 - Ammonium chloride-ammonium hydroxide

3. Colorimetry

- To verify Beer-Lambert law for $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution.
- Determination of Fe^{3+} content by thiocyanate method.

4. Chemical Kinetics

- To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature
- To study the effect of acid strength on the hydrolysis of an ester
- To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate
- To study kinetically the reaction rate of decomposition of iodide by H_2O_2

5. Molecular Weight Determination

- Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.
- Determination of the apparent molecular weight of non volatile solute at different concentration and determine Van't Hoff factor by ebullioscopy.

6. Determination of melting point

- Naphthalene $80-82^\circ\text{C}$, Benzoic acid $121.5-122^\circ\text{C}$, Urea $132.5-133^\circ\text{C}$, Succinic acid $184.5-185^\circ\text{C}$, Cinnamic acid $132.5-133^\circ\text{C}$, Salicylic acid $157.5-158^\circ\text{C}$,

Acetanilide 113.5-114⁰C, m-nitrobenzene 90⁰C, p-ichlorobenzene 52⁰C, Aspirin 135⁰C.

7. **Determination of boiling point**
 - Ethanol 78⁰C, Cyclohexane 81.4⁰C, Toluene 110.6⁰C, Benzene 80⁰C.
8. **Mixed melting point determination**
 - Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).
9. **Thin Layer Chromatography:** Determination of *R_f* values and identification of organic compounds:
 - Separation of green leaf pigments (spinach leaves may be used)
 - Preparation of separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2, and 3-one using toluene and light petroleum (40:60)
 - Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)
10. **Paper Chromatography:** Ascending and Circular: Determination of *R_f* values and identification of organic compounds:
 - Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent – ninhydrin.
 - Separation of a mixture of D, L – alanine, glycine, and L-leucine using n-butanol:acetic acid:water (4:1:5). Spray reagent – ninhydrin.
 - Separation of monosaccharides – a mixture of D-galactose and D fructose using n-butanol:acetone:water (4:5:1). Spray reagent – aniline hydrogen phthalate.
11. **To detect the presence of functional groups in given organic compound.**



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**Syllabus for Trade Test / Paper -III Test for the post of Technical Assistant, Post Code:
 TA2 , Area: Electrical Engineer against Advt. No. IITR/1/2024.**

Electrical Branch

Basic Concepts:	Concepts of resistance, inductance, capacitance and various factors affecting them Concepts of current voltage, power, energy and their unit.
Circuit Law:	Ohms Law, Simple Circuit solution and calculations using Ohms Law.
Magnetic Circuits	Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, inductance, inductance calculation in series and parallel.
Electro statics	Concepts of electric flux, emf, capacitors, values of capacitors, measurement of capacitors, capacitor calculation in series and parallel.
AC Fundamentals	Instantaneous, peak, RMS and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of RL and C, Resonance, Tank Circuit Poly Phase system – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.
Measurement and measuring instruments	Measurement of power (1 phase and 3 phase, both active and re-active) and energy, 2 wattmeter method of 3 phase power measurement, Measurement of frequency and phase angle Ammeter and Voltmeter (both moving oil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges Use of CRO, Signal Generators, CT, PT and their uses Earth Fault directions.
Electrical Machines:	(a)DC Machine – Construction, Basic Principles of DC motors and generators, their characteristics, speed control and starting of DC Motors Methods of braking motor, 17 Losses and efficiency of DC Machines (b) 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, voltage regulation, OC and SC Tests, Losses and efficiency Effect of voltage, frequency and wave form on losses Parallel operation of 1 phase/3 phase transformers Auto transformers (c) 3 phase induction motors, rotating magnetic field, principles of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors Methods of braking effect of voltage and frequency variation on torque speed characteristics Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications.
Synchronous Machines	Generation of 3-phase emf armature reaction, Voltage regulation, basic knowledge of AC alternators, synchronizing, control of active and reactive power Starting and applications of synchronous motors.
Generation, Transmission and Distribution	Different types of power station, Load factors, diversity factors, demand factors, cost of generation, inter-connection of power stations Power factors improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults Switchgears – rating of circuit breakers, Principles of arc extinction by oil and air, HRC Fuses, Protection against earth leakage / over current etc. Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system Cable – Different type of cables, cable rating and derating factor.

Estimation and costing	Estimation of lighting scheme (domestic as well as industrial wiring), electric installation of machines and relevant IE rules Earthing practices and IE Rules, load calculation.
Utilization of Electrical Energy	Illumination, different type of light fittings, Electric heating, Electric welding, Electroplating, Electric drives and motors (three phase and single phase), Basic knowledge of lift and escalators.
Protective device	Basic knowledge of earthing, Lightning conductor, surge protector and isolation transformer.
Alternator	Maintenance and varnishing of alternations.



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Syllabus for Trade Test/Paper -III Test for the post of Technical Assistant, Post Code: TA3, Area: Civil Engineer against Advt. No: IITR/1/2024.

Civil Engineering

1. Basic Knowledge of MS WORD, MS EXCEL and auto CAD.
2. Engineering and Building Drawing: Scales, Lettering Dimensioning, Orthographic, Isometric, Sections, Common Symbols and conventions, Drawing of building components as Walls, Footing, Doors, Windows, Staircases.
3. Environmental Engineering Ecology and Environment, disaster management Building water supply, Quantity and Quality of water, water treatment, waste water and sewage treatment, laying and construction of sewers and solid waste management.
4. Fluid Mechanics: Units and Measurement Properties of fluids. Hydrostatics forces flow through pipes and channels, pumps and turbines, Water Methods of irrigations, Hydrology, Runoff, requirement for Crops, wells and tube wells, Cross draining works. Water logging river training works.
5. Applied Mechanics, SOM and structural Analysis Force System, equilibrium, friction, centroid, moment of inertia. Kinematics and Kinetics of rigid bodies, Simple stresses normal stresses, Shear stresses in beams. Shear force and bending moment diagrams for determinate beams and frames.
6. Surveying Basic principles of chain surveying Compass surveying Leveling Plane Table, Theodolite and Total Station surveying.
7. Building Materials and Building Construction knowledge of different building materials including Testing for Bricks, Solid and Hollow Blocks, stones, cement, aggregates, concrete, steel lime, paints and varnishes. Bitumen Timber and Aluminium and Joinery Works. Construction of building using framed construction in concrete and steel and load bearing structures Surface finishes, Brick Masonry, Stone masonry and composite construction.
8. Concrete Technology: Properties of concrete in fresh and hardened state water cement ratio, hydration process, Design mix of concrete. Laboratory and field tests on concrete Compaction finishing and curing of concrete, Basic knowledge of special concretes, Ready Mix concrete Fibre Reinforced concrete. Self Compacting concrete, high strength Concrete etc.

9. Reinforced Cement Concrete and Steel Design Philosophies, Design using Limit State method for Beams, slabs, columns, staircases and footing for Strength and serviceability. Design of steel Beams tension members, compression members, built-up beams, plate girders roof trusses etc. Earthquake resistant design. Knowledge of related latest IS codes, IS 1893, IS456 IS800 IS13920 IS4326 etc.
10. Highway Engineering: Materials involved in Highway Construction. Type of Highway pavements, Hill road, drainage and Highway maintenance.
11. Soil Mechanics and foundation engineering Properties of different types of soils, effective stress, deformation of soil compaction, consolidation shear strength, Soil exploring, Bearing Capacity of soil, Earth pressure and stability of Retaining walls etc.
12. Estimation and Costing: Specifications, Analysis of rates, Preparations of tender documents, Accounts and procedures. Arbitration and disputes Schedule of rates, Estimation of building works, Highway works Drainage works, water supply and sanitary installations electrical Installations. Construction Project management, PERT, Planning, Organization, Labour Scheduling Control of Progress, safety, Inspection and Quality control, Repair and Maintenance of building works.



**Syllabus for Paper –III for the post of Technical Assistant, Post Code : TA4 Area:
Animal House & GLP Facility against Advt. No: IITR/1/2024.**

Unit 1: Introduction to laboratory animal science.

- Overview of lab animal science
- Importance in biomedical research

Unit 2: Different lab animal species commonly reared/used and their application in Research

Mice (*Mus musculus*)

- Biological characteristics: genetics, behavior, and lifespan
- Common uses: genetic research, cancer studies, behavioral studies

Rats (*Rattus norvegicus*)

- Biological characteristics: physiology and social behavior
- Common uses: pharmacology, toxicology, neuroscience

Rabbits (*Oryctolagus cuniculus*)

- Biological characteristics: anatomy and reproductive behavior
- Common uses: immunology, vaccine development, drug testing

Guinea Pigs (*Cavia porcellus*)

- Biological characteristics: social structure and vocalizations
- Common uses: respiratory studies, infectious disease research

Zebrafish (*Danio rerio*)

- Biological characteristics: rapid development and transparency of embryos
- Common uses: developmental biology, genetic studies, toxicology

Unit 3: Routine care, Maintenance & husbandry practices while rearing laboratory animals.

Species-specific care – Mouse, Rat, Rabbits, Guinea Pig, Zebrafish

- Nutrition and dietary requirements
- Housing and environmental enrichment
- Breeding and genetics management

Unit 4: Differentiating between healthy / unhealthy (sick) lab animals, signs of good health.

- Preventive health care practices
- Disease recognition and management
- Biosecurity Measures

Unit 5: Handling Laboratory animals

- Routine sampling procedures
- Other minor procedures including restraining.
- Stress reduction techniques during handling

Unit 6: Anaesthesia in lab animals

- Anaesthetic agents and methods of anaesthesia
- Anaesthesia protocols and recovery
- Anaesthesia for surgical Procedures

- Pain management

Unit 7: Managing pain & distress in lab animals, humane end points in terminal lab animal experiments.

- Understanding pain and distress in laboratory animals
- Assessment of pain and distress (behavioural indicators, physiological indicators)
- Humane endpoints in terminal lab animal experiments

Unit 8: Other lab animal Models

- Transgenic laboratory animals
- Larger mammals used as lab animals,
- Genetically modified species.

Unit 9: Gross and Histopathology techniques

- Introduction to pathology – gross and histopathology
- Types of specimens and material obtained in histopathology laboratory
- Biopsy and cytology techniques.
- Fixation (fixatives- properties of fixatives, types of fixatives)
- Tissue processing of histological tissues for paraffin embedding
- Embedding and microtomy
- Stains and staining techniques

Unit 10: Haematology

- Introduction to haematology
- Equipment used in haematology lab
- Routine haematological tests
- Haemostasis, coagulation tests

Unit 11: Clinical Biochemistry

- Introduction and instrumentation in a clinical biochemistry laboratory
- Common clinical chemistry tests
- Biochemistry analyzer
- Urinalysis

Unit 12: Rules & Regulation governing lab animal rearing

- AWA (Animal Welfare Act)
- IAEC
- 3 R Principle (Replacement, Reduction, Refinement)
- CCSEA
- Ethical Consideration in Animal Research

Syllabus for Trade Test

Unit 1: Introduction to laboratory animal science and GLP Practices

- Identification of instruments / equipment used in animal facilities
- Standard Operating Procedures (SOPs) preparation
- Data recording in animal facility

Unit 2: Different lab animal species commonly reared/used and their application in Research

Mice (*Mus musculus*)

- Identification and general handling of laboratory animals

- Common uses of different animal models

Unit 3: Routine care, Maintenance & husbandry practices while rearing laboratory animals.

Species-specific care – Mouse, Rat, Rabbits, Guinea Pig, Zebrafish

- Nutrition and dietary requirement
- Housing and environmental enrichment
- Identification of common animal house pests
- Disposal of various wastes from an animal facility

Unit 4: Differentiating between healthy / unhealthy (sick) lab animals, signs of good health.

- Preventive health care tools
- Disease recognition
- Biosecurity tools and practices

Unit 5: Handling Laboratory animals

- Sample collection procedures
- Other minor procedures including restraining.
- PPE and health precautions including hygiene and sanitation

Unit 6: Anaesthesia in lab animals

- Anaesthetic agents and methods
- Anaesthesia for surgical Procedures
- Pain management
- Approved methods of laboratory animal euthanasia

Unit 7: Other lab animal Models

- Transgenic laboratory animals / Genetically modified species
- Larger mammals used as lab animals

Unit 8: Gross and Histopathology techniques

- Gross and histopathology techniques
- Types of specimens and fixatives
- Biopsy and cytology tools
- Stains and staining techniques

Unit 9: Haematology&Clinical Biochemistry

- Equipment used in haematology lab and clinical biochemistry laboratory
- Routine haematological and clinical chemistry test
- Coagulation tests and Urinalysis



**Syllabus for Trade Test/ Paper –III of written exam for the post of Technical Assistant,
Post Code : TA5 Area: Biological Sciences against Advt. No: IITR/1/2024.**

Biological Sciences

1. Animal Diversity

- Protozoa to echinodermata: salient features and classification up to classes, morphology and specific organizational systems and their structure and function
- Hemichordata to chordata:
- general characters and classification up to orders along with prototype organisms and structure and function of various body systems

2. Ecology

- Introduction, history and scope of ecology
- Ecological factors
- Pollution and its control (Air, Water & Soil)
- Phytoremediation

3. Health and Hygiene

- Introduction and determinants and factors affecting health and hygiene
- Pollution and associated hazards; water and air borne diseases
- Micro and macro nutrients, balanced diet and malnutrition
- Diseases caused by deficiency of proteins, vitamins and minerals

4. Pisciculture

- An introduction to aquaculture and types of fish ponds and their management
- Feeding practices and types of feed used in pisciculture

5. Developmental Biology

- Basic concepts.
- History and steps involved in preformation, epigenesis, cell interaction, reproduction, gametogenesis, spermatogenesis, oogenesis, fertilization and post-fertilization
- Planes and patterns of cleavage, placenta and teratogenesis

6. Animal Behaviour

- An introduction to animal behaviour, biological clocks, innate behaviour and learning behaviour.

7. Biotechniques

- Major tools and techniques involved in microscopy, biochemistry, physiology, immunology, endocrinology
- Cell culture and handling of laboratory animals

8. Cell Biology

- Structure of prokaryotic and eukaryotic cells
- Major organic and inorganic constituents of cells
- Structure and function of extracellular matrix, cell wall and cell membranes
- Structure and function of cellular organelles, signal transduction, chromosomes, chromatin and nucleosome
- An introduction to tissues and histological techniques
- Classification, gross organization and fine structure of bone
- Mitosis and meiosis
- Molecular basis of cell cycle
- Numerical and structural variations in chromosomes and their significance
- Structure and function of nervous tissue

9. Genetics and Molecular Biology

- Mendelian genetics, extensions, modifications and exceptions
- Structure and synthesis of nucleic acids and proteins
- Chromosome, DNA, RNA, replication, transcription, translation, proteins synthesis
- Genetic code and regulation of gene expression
- Sex chromosomes and sex-linked inheritance
- Extranuclear / cytoplasmic inheritance
- Mutation (biochemical and molecular basis)

10. Animal Physiology and Biochemistry

- Introduction to nutrition, digestion, circulation, respiration, muscle contraction, thermoregulation, nervous integration, sense organs, endocrine system, excretion, osmoregulation and reproduction
- Metabolism and biosynthesis of carbohydrates, proteins, fats and nucleic acids

11. Toxicology

- Exposure to toxicants: routes/methods of exposure, frequency and duration of exposure, human exposure, dose-response relationship
- Concept, significance, basic mechanisms of selective toxicity

- Bioassay, acute toxicity tests for terrestrial and aquatic animals, chronic toxicity tests
Concept of maximum acceptable toxicant concentration and safe concentration
- Factors affecting toxicity, factors related to the chemical exposure, surrounding medium and the organisms
- Bio-accumulation and bio-concentration of xenobiotics.



Syllabus for Trade Test/ Paper –III of written exam for the post of Technical Assistant,
Post Code : TA6 Area: Environmental Monitoring Impact / Assessment against
Advt. No: IITR/1/2024.

Environmental Monitoring Impact / Assessment

Mathematics: Algebra - Arithmetic mean, geometric mean, Trigonometry - Measurement of angles in degrees, grades and radians, Geometry - Equation of a straight line, intersection of two straight lines, angle between two lines, perpendicular distance formula, General equation of a circle, Statistics - Mean, median and mode.

Physics: Need of measurement, fundamental and derived units, systems of units (FPS, CGS and SI units), Acceleration due to gravity, Scalar and vector quantities, units of power, work and energy, Pressure - its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer, Concept of heat and temperature - different scales of temperature, Wave motion - Transverse and longitudinal wave motion. Sound and light waves and their properties, Noise Pollution -Sources and effects of noise pollution, noise level standards as per CPCB, control of noise pollution.

Chemistry: Chemical bonding, ionic bonding (NaCl), covalent bond (H₂, F₂, CH₄, NH₃, H₂O), coordination bond in NH₄⁺, and anomalous properties of NH₃, H₂O due to hydrogen bonding, and metallic bonding, Solution - idea of solute, solvent and solution, methods to express the concentration of solution molarity (M = mole per liter), Molality, Normality, ppm, mass percentage and volume percentage.

Computer and IT systems: Computer generations, types of computers and their components, MS Office (Word, PowerPoint and Excel), search engines and web browsing.

Applied Mechanics: Resolution of a force - orthogonal components of a force, moment of a force, Composition of forces -resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems - Law of triangle, parallelogram and polygon of forces. Beam- Types of beams, supports and loads acting on beam, Beam reaction for cantilever, simply supported beam with Friction – Coefficient of friction, and application of friction, centroid and centre of gravity.

Fluid Mechanics: Properties of fluids - density, specific weight and gravity, viscosity and its types; Concepts of fluid motion, stream line and turbulent flow, Surface tension and Capillarity; Hydrostatic pressure; Reynold's number, equation of continuity, Bernoulli's Theorem applications, Flow measurements.

Water and Water Pollution: Water distribution on Earth, consumption of water, soft and hard water, salts causing water hardness, problems caused by hard water in boiler, Sources of water pollution, impurities in water (physical, chemical, biological) and effects on human health, testing water quality parameters: turbidity, pH, TSS, TDS, O₂, Rain water harvesting system, Indian Standards Specification of drinking water.

Fuels: Combustion of fuels, HCV and LCV using Dulong's formula, proximate analysis of coal, Fuel rating (octane and cetane numbers), chemical composition, calorific values and applications of coal, petrol, diesel, LPG, CNG and biogas.

Non-Conventional Energy: Application of non-conventional energy sources /uses in India.

Vehicles and transportation: E-vehicles in India, Comparison of vehicles- based on type of engine/ technology and type of fuel, Classification of Roads, Traffic signals.

Environment: Component of environment and their interaction: atmosphere, lithosphere, hydrosphere and biosphere, basics of ecology, eco system- concept, sustainable development, renewable and non-renewable resources, Global Warming, Climate Change, Ozone hole, Green House Effect, Acid Rain, Green Building, Ground water recharge, deforestation.

Air pollution: Source - industry, vehicles and solid waste burning, National Ambient Air Quality Standards (NAAQS-2009), stack emissions from coal fired thermal power plants, air pollution control, impacts of air pollution - human health, plants and economy, Air Pollution and its Prevention and Control Act 1981 & Environmental Protection Act 1986, and National Green Tribunal (NGT).

Soil Pollution and Solid Waste: Sources of soil pollution, Municipal solid waste, biomedical, industrial solid waste, E-waste, plastic waste, effects of solid waste, solid waste management.

Disaster and Causes of Hazards: Natural disasters, manmade Disasters, role and guidelines of National Disaster Management Authority (NDMA), mechanism for disaster control: NDRF (National Disaster Response Force), SDRF (State Disaster Response Force), DDRF (District Disaster Response Force) and Aapda Mitra in disaster management in India.



Syllabus for Trade Test / Paper-III of Written Exam for the post of Technical Assistant, Post Code : TA7
Area: Epidemiology including Occupational Health and Safety Risk Assessment against Advt. No:
IITR/1/2024.

Unit 1: Introduction to Epidemiology

- Definition and scope of epidemiology
- History of epidemiology
- Epidemiologic concepts: distribution, determinants, frequency, and associations
- Epidemiologic triangle (agent, host, environment)

Unit 2: Measures of Disease Frequency

- Incidence and prevalence
- Rates and ratios
- Standardization
- Measurement error and bias

Unit 3: Study Design

- Descriptive studies (case series, case reports)
- Analytic studies (cohort, case-control, cross-sectional)
- Experimental studies (clinical trials)
- Study validity and reliability

Unit 4: Data Collection and Analysis

- Sources of data (surveillance, surveys, administrative records)
- Questionnaire design and validation
- Data quality control
- Basic statistical analysis (descriptive statistics, hypothesis testing)

Unit 5: Inferential Statistics

- Confidence intervals
- Hypothesis testing (t-tests, ANOVA, regression)
- Non-parametric tests
- Statistical software applications

Unit 6: Epidemiologic Research Methods

- Study protocol development
- Sampling methods
- Data management and quality control
- Research ethics

Unit 7: Infectious Disease Epidemiology

- Transmission dynamics
- Outbreak investigation
- Vaccine efficacy and effectiveness
- Immunization programs

Unit 8: Chronic Disease Epidemiology

- Risk factors and prevention
- Screening and early detection
- Cancer epidemiology
- Cardiovascular disease epidemiology

Unit 9: Genetic and Molecular Epidemiology

- Genetic epidemiology
- Molecular epidemiology
- Biomarkers and susceptibility
- Gene-environment interactions

Unit 10: Epidemiology and Public Health Practice

- Surveillance and monitoring
- Health policy and planning
- Program evaluation
- Evidence-based practice

Recommended Textbooks:

1. "Epidemiology: Beyond the Basics" by Moyses Szklo and F. Javier Nieto
2. "Principles of Epidemiology" by the Centers for Disease Control and Prevention (CDC)
3. "Epidemiology for Public Health Practice" by Robert H. Friis and Thomas A. Sellers
4. "Basics of Epidemiology - Concepts Made Simple" by Anil Mishra
5. Epidemiology for Undergraduates by Rajan Marina Joseph



Syllabus for Paper –III of Written Exam for the post of Technical Assistant, Post Code :
TA8 Area: Industrial research/ HR/ Outreach and Public /Social Communication
advertised against Advt. No: IITR/1/2024.

1. Fundamentals of Industrial Research

- **Introduction to Toxicology**
 - Definition and Importance
 - Overview of Toxicological Research Areas
 - Overview of industry support translational activities of the institute.
- **Research Methodologies**
 - Basics of Experimental Design
 - Data Collection Methods (surveys, observations, lab experiments)

2. Human Resources (HR) Essentials

- **Role of HR in Organizations**
 - Key Functions: Recruitment, Training, Performance Management
- **Basic HR Policies and Practices**
 - Employee Rights and Responsibilities
 - Importance of Communication in HR

3. Outreach and Public Communication

- **Introduction to Outreach Programs**
 - Objectives and Significance in Toxicology
 - Types of Outreach Activities (workshops, seminars)
- **Effective Communication Skills**
 - Verbal and Non-Verbal Communication
 - Public Speaking Techniques

4. Social Media and Digital Outreach

- **Understanding Social Media Platforms**
 - Role of Social Media in Public Awareness
 - Basic Strategies for Effective Online Communication
- **Content Creation Basics**
 - Writing for Social Media (posts, infographics)
 - Designing Simple Visuals (using tools like Canva)

5. Basic Technical Skills

- **Computer Literacy**
 - Proficiency in Word Processing, Spreadsheets, and Presentations
- **Introduction to Research Tools**
 - Basic Data Analysis and Research Documentation

6. Project Management and Teamwork

- **Planning and Organizing Projects**
 - Setting Goals and Objectives for Outreach Activities
- **Team Collaboration**
 - Roles in a Team and Effective Teamwork Strategies

Syllabus for Trade Test

Test Components

1. Practical Skills Assessment

○ Presentation Exercise

- Prepare and deliver a 5-minute presentation on a given topic related to toxicology outreach (evaluation based on clarity, engagement, and use of visuals).
- Prepare a Google form for a given event.

○ Technical Task

- Create a simple report using word processing software, summarizing findings from a hypothetical toxicology study, focusing on format and clarity.
- Prepare a press note for Jigyasa related activities.

2. Group Activity

○ Role-Playing Exercise

- Simulate a team meeting to discuss an outreach program; assess communication, teamwork, and problem-solving skills.

○ Collaborative Planning

- Work in groups to design a basic outreach plan for a community awareness program about toxicology, including objectives, activities, and target audience.

3. Skill Development.