DETAILED SYLLABUS FOR THE POST OF LAB ASSISTANT IN KERALA WATER AUTHORITY

(Category Nos.:431/2023)

PART I : MLT (50 Marks)

MODULE I – 10 Marks

BASIC LABORATORY TECHNIQUES:

• Knowledge of Laboratory chemicals- hazard symbols, warning symbols, safety precautions and storage of chemicals
• Cleaning of glassware – general glass wares, new glass wares, blood- stained pipettes, slides, culture plates etc.
• Cleaning and disinfection of Disinfectants used and biosafety precautions in case of specimen spillage
• Bio- medical waste management -categories of bio-medical waste. Bio- medical waste – color coding, types of containers, collection, transport and disposal of biomedical waste.
• Basic first aid techniques for cuts & bruises, burn injury etc.
• Sample collection and processing – barcoding, safety precautions, processing of samples etc.
• Common Instruments used in laboratories – incubators, centrifuge, semi autoanalyzer, Colorimeter, Micropipettes etc
• Distillation and deionisation apparatus and use
• Laboratory management system

MODULE II- 13 Marks

BLOOD AND PHLEBOTOMY - 10 Marks

• Methods of blood collection –
    o Capillary Puncture
    o Arterial puncture and venous puncture
    o Vacutainer – colour codes for vials
• Sites of blood collection: Capillary and Venous.
• Anticoagulants used – advantages and disadvantages
• Identification of blood cells: Leishman's staining procedure & identification
• Blood cell types: RBC, WBC, Platelets (Identifying characters and Normal Range)

HEMATOLOGY

• Heamocytometry Counting chamber : improved Neubauer
• Total cell counts:
• RBC, WBC, Platelet, Absolute Eosinophil count. (Diluting fluids, Normal value, Clinical Significance),
• Reticulocyte count : Clinical significance
• Hemoglobin estimation : Enumerate methods ,WHO recognized method : cyanmethhaemoglobin method, significance.

• PCV – Methods, Wintrobe 's method, Normal value clinical significance.
• ESR- Method (westergren's method), Normal value, Clinical Significance.
• Test for coagulation:
• Bleeding time methods & Normal value of Duke's method.
• Clotting time methods & Normal value of Capillary tube method
• Automation- Heamotology analyser, Haemogram, CBC – principle

BLOOD BANKING AND IMMUNO HAEMOTOLOGY – 3 Marks
• Blood group antigens and antibodies.
• Blood group system. (ABO and Rh system in detail,)
• Blood grouping techniques.
    1. Cell grouping and Serum grouping.
    2. Slide and tube method

Transfusion phlebotomy
- Donor screening, Donor selection criteria.
- Blood bank-Anticoagulants
- Compatibility testing and issue of blood.
- Cross matching-Minor and Major. Mention 3 phases.
-

MODULE III – 15 Marks

CLINICAL PATHOLOGY - 5 Marks
• Analysis of Urine, Sputum, Stool, Semen, CSF
• -Types of sample, collection of sample, Physical, Chemical & Microscopic examination techniques & their Importance

BIOCHEMISTRY - 10 marks
Blood Glucose estimation
• Types of samples: FBS, PPBS ,RBS
• Methods of estimation – enzymatic method and glucometer (dry chemistry)
• Normal value,
• Clinical significance,
• Relevance of HbAlc

Renal function test
• Enumerate the common test included.
• Common method used for the estimation of Blood urea, Serum creatinine (normal values). Clearance test (Urea & Creatinine)

Liver function test
• Common tests included. Method used for estimation of Bilirubin (Malloy and Evelyn method)
• Lipid profile Tests included in lipid profile
• Common method for the estimation of cholesterol.

Other parameters of Diagnostic importance.
• Serum electrolytes: Sodium, Potassium. Normal value and Clinical significance.
• Name cardiac Markers.

• Name Tumourr Markers.
• Clinically important hormones & enzymes

Automation in Biochemistry

• Types of analyser, various Assay techniques, POCT etc

MODULE IV- 12 Marks

MICROBIOLOGY – 5 Marks
• Classification of bacteria based on Morphology.
Sterilization methods.
• Hot Air Oven, Autoclave (Operation procedure , preparation of articles ,precautions to be taken and use)
• Disinfectants & Antiseptics (Application)
• Culture Media: Classification of culture media with example (knowledge assessment)
• Culture Methods: Streak, Stroke, Stab, Lawn culture, Anaerobic technique (gaspak) (Knowledge assessment)
Identification of bacteria :
• Different methods .
• Detection of motility : Names of different methods (Hanging Drop Method)
• Staining : (Simple stain, gram stain, AFB stain)- techniques and diagnostic significance.
• Biochemical tests : Oxidase, Coagulase, Catalase, & IMViC
• Serological techniques- Agglutination test- Widal test , Precipitation test- RPR/VDRL, ELISA, PCR

Parasitology – 2 Marks
Laboratory diagnosis of Malaria

- Disease, Mode of transmission, host, causative agent & types of Malaria
- Thick and thin smear preparation – advantages and disadvantages
- Stains used: Leishman, fildes JSB etc
- Other methods : card method , QBC.

Laboratory Diagnosis of Filariasis .

- Disease, mode of transmission, host and nocturnal habit.
- Lab diagnosis : Wet smear examination , thick smear examination, concentration techniques.

Histotechnology and cytology histotechnology : - 5 Marks

Tissue processing (steps of tissue processing), fixation techniques, Histokinette, Microtomes, staining: (H and E stain)
Diagnostic cytology : Types of specimen , Processing , Fixation (fixatives used), Staining, advantages and application of diagnostic cytology

PART II : PHYSICS (15 Marks)

Module I - 4 Marks

Units and Measurements:

System of Units – CGS and S.I System, Multiples & sub multiples of unit, Parallax method – for measurement of large distances, Significant figures, Accuracy and Precision, Errors in measurement and Calculation.

Kinematics – Motion in a straight line and plane.

Graphical representation of motions – Position time graph and velocity time graph, Equation of motion, Displacement and distance, Velocity and acceleration, Vector addition – Triangular law and Parallelogram law, Uniform circular motion – Centripetal force and acceleration.

Dynamics – Laws of motion and Work, Energy & Power.

Newton's laws of motion, Impulse and its application, Law of conservation of momentum – Recoil of gun, Friction – Laws of static and kinetic friction, angle of repose, Methods of reducing friction.

Different types of work, Kinetic and Potential energy, Power, Collision -Elastic and Inelastic collision.

System of Particles and Rotational motion & Gravitation

Law of conservation of angular momentum and its application, Torque and Angular momentum, Moment of Inertia of regular bodies – Ring, disc, sphere and Cylinder, Theorem on Moment of Inertia – Parallel axes and Perpendicular axes, Kinetic energy of rolling bodies

Acceleration due to gravity (g) and its variation with depth and height, Orbital velocity and time period of satellite, Escape velocity, Kepler's third law.

Module II - 3 Marks

Mechanics of Solids and fluids

Elasticity – Stress and strain, Moduli of elasticity -Young, Bulk and rigidity, Stress strain graph, Fluid pressure, Pascal's law and its applications, Surface tension, Viscosity, Bernoulli's theorem and its application, Equation of continuity, terminal velocity.

Heat and Thermodynamics

Principle of mixture, Scales of temperature, Specific heat capacity, First and second law of thermodynamics, Isothermal and adiabatic process, Carnot's Heat engine.

Oscillation & Waves

Simple Harmonic Motion (SHM), simple pendulum, Longitudinal and transverse waves, Vibration in air column – Open pipe and closed pipe, Beats and doppler effect.

Module III - 4 Marks

Electrostatics

Quantization of charge, Coulomb's law, Electric field, Gauss's theorem and its application, Equi potential surfaces, Capacitance, Parallel plate capacitor, combination of capacitors -series & Parallel.

Electro dynamics- Current Electricity

Ohm's law, Electric current and current density, Colour code of resistors, Resistivity and conductivity, Drift velocity and mobility, Potentiometer.

Moving charges and magnetism

Biot-Savart's law and its application – circular coil, Solenoid and Toroid, Galvanometer to ammeter and voltmeter, Classification of magnetic materials – dia, para and ferro materials, Magnetic field lines.

Electromagnetic induction & AC

Faraday's laws, Eddy current and its applications, Self induction, AC generator, Transformers, Wattless current and Q-factor of LCR circuit, Reactance of ac circuits.

Electromagnetic waves

Properties of Electro magnetic waves and its uses, Electromagnetic spectrum.

Module IV - 4 Marks

Ray and Wave optics

Reflection of spherical mirrors, Refraction and its application, Total internal reflection and its applications, Lens maker's formula, Power of a lens, Combination of lens, Scattering and dispersion, Microscope, Interference -Young's double slit experiment, Polarisation -Malu's law and Brewster's law.

Modern Physics – Dual nature of radiation & matter, Atoms & nuclei

Photo electric effect, Einstein's Photo electric equation, Matter waves, Bohr atom model -Spectral series of Hydrogen atom, Half life period and nuclear reactor.

Semiconductor physics

Concept of Energy band – Classification of materials – conductor, insulators and semiconductors, Properties of semiconductors, Dopping, Intrinsic and extrinsic semiconductor, N type and P type semiconductors, P N junction diode, Half wave and full wave rectifiers, Zener diode, Photo diode and LED.

PART III : CHEMISTRY (14 Marks)

Module I : Physical Chemistry (4 Marks)

Some basic concepts of chemistry-mole concept calculation, definition of molarity, molaritycalculations.

Structure of atom-Different atom model –Rutherford, Neils Bohr, concepts of orbitals,quantum number,shape of s,p,and d orbitals, rules for filling electrons in orbitals

Equilibrium- concept of P^H

Electrochemistry-Different types of electrochemical cells(Galvanic ,also called voltaic and electrolytic)

Surface chemistry – Colloids and emulsions- type of colloids with examples – colloids around us

Moduel II : Inroganic Chemistry (5 Marks)

Periodic classification of elements- Modern periodic table and the present form of periodic table,periodic trends in properties and their variation along a group and period with reason–atomic radii, electronegativity

Hydrogen – Types of water- Hardness of water-causes of hardness and its removal,Hydrogen peroxide

S-block elements -Biological importance of sodium and calcium

P-Block elements- Allotrops of diamond and Graphite their structure and properties,Compouds of nitrogen –Ammonia and Nitric acid ,compounds of Sulphur-sulphuric acid

Applications of d & f block elements

Moduel II : Organic Chemistry (5 Marks)

Organic chemistry some Basic principles and techniques- IUPAC nomenclature of organic compounds, Different method used for purification of organic compouds-distillation,crystallization,sublimation

Hydrocarbons –General formula of alkanes

Test for alcohols,phenol,aldehydes ,ketones

Alcohol -Isopropyl alcohol,glycerol

Chemistry in Everyday life –Chemistry in food ,medicines (Anticeptic, antibiotic) ,cleansing agents

Biomolecules-Carbohydates,proteins,vitamins ,nucleic acids

Polymers-Poly styrene,Polyurethane,Silicones,Poly carbonates,Polyether,Polyester

PART : IV BOTANY (07 marks)

MODULE I : CELL STRUCTURE AND FUNCTION (1 Marks)

- CELL THE UNIT OF LIFE
  - Cell Theory
  - Prokaryotic and Eukaryotic cells
  - Cell organelles - Structure and function.
- CELL CYCLE AND CELL DIVISION
  - Cell Cycle
  - Phases of cell cycle – Interphase , Mitosis , Meiosis .

MODULE II : REPRODUCTION (2 Marks)

- REPRODUCTION IN ORGANISMS
  - Asexual reproduction – Methods
  - Vegetative propagules
  - Sexual reproduction – Events , Ovipary, Vivipary.
- SEXUAL REPRODUCTION IN FLOWERING PLANTS .
  - Stamen, Microsporangium, Pollen grain – Structure and development.
  - Pistil , Megasporangium (Ovule) – Structure and development.
  - Pollination , Outbreeding devices
  - Artificial hybredisation
  - Double fertilization
  - Endosperm , Embryo , Seed
  - Apomixis , Polyemryony.

MODULE III: BIOLOGY IN HUMAN WELFARE (1 Mark)

- STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION .
  - Animal husbandry
  - Management of farms and farm animals , Animal breeding , Bee keeping , Fisheries
  - Plant breeding ,Biofortification
  - Single cell protein

- Tissue culture.

MODULE IV : BIOLTECHNOLOGY (2 Marks)

- BIOTECHNOLOGY PRINCIPLES AND PROCESSES
  - Principles of biotechnology
  - Tools of recombinant DNA technology
  - Separation and isolation of DNA fragments (Gel electrophoresis)
  - Cloning vectors
  - Process of recombinant DNA technology – Isolation of DNA, Amplification of gene of interest using PCR , Obtaining foreign gene product , Downstreaming process.

BIOTECHNOLOGY AND ITS APPLICATIONS

- Biotechnological applications in agriculture
- Biotechnological applications in medicine
- Transgenic animals
- Ethical issues.

MODULE V : ECOLOGY (1 Marks)

ORGANISMS AND POPULATIONS

- Organisms and its environment , Abiotic factors , Response to abiotic factors
- Adaptations
- Populations – Population attributes , Population growth , Life history variation , Population interactions .

ECOSYSTEM

- Ecosystem-Structure and Function
- Productivity
- Decomposition ,
- Energy flow
- Ecological Pyramids
- Ecological Succession – Hydrarch Succession , Xerarch Succession.
- Nutrient cycling.

ENVIRONMENTAL ISSUES

- Pollution – Air , Water
- Greenhouse effect and global warming ,Ozone depletion
- Deforestation , Reforestation
- People’s participation in conservation of forests.

PART V : ZOOLOGY (07 Marks)

MODULE I : HUMAN PHYSIOLOGY (3 marks)

DIGESTION AND ABSORPTION

Parts of Human Digestive system, Mechanism of Carbohydrate, Protein and fat digestion

BREATHING AND EXCHANGE OF GASES

Parts of Human Respiratory system, Mechanism of Breathing in man, Transport of Carbon dioxide and oxygen through blood

BODY FLUIDS AND CIRCULATION

Structure of Human heart, Cardiac cycle, ECG

EXCRETORY PRODUCTS AND THEIR ELIMINATION

Parts of Human kidney, Process of Urine Formation, Hormonal regulation of Kidney Function

LOCOMOTION AND MOVEMENT

Three types of muscles, Mechanism of muscle Contraction, Human skeleton, Types of Joints

NEURAL CONTROL AND COORDINATION

Structure of Neuron, Parts of human brain, Structure of Eye and Ear

CHEMICAL COORDINATION AND INTEGRATION

Endocrine glands, hormones and their functions,

HUMAN REPRODUCTION

Structure of Male and Female reproductive system, Gametogenesis, Fertilization, Implantation, Functions of Placenta, Embryonic development,

REPRODUCTIVE HEALTH

Sexually transmitted diseases, Contraceptives, Assisted Reproductive Technologies

MODULE II : GENETICS (2 marks)

HEREDITY AND VARIATION

Non Mendelian inheritance – Co dominance, Multiple alleles
Chromosomal and Mendelian disorders, Sex determination in humans

MOLECULAR BASIS OF INHERITANCE

Structure and functions of DNA, Central Dogma-Transcription and Translation, DNA Finger printing

MODULE III : BIOLOGY IN HUMAN WELFARE (1 mark)

HUMAN HEALTH AND DISEASES

Types of Immunity, Immune system of human body, Allergy, AIDS, Cancer

Module IV) ANIMAL KINGDOM (1 marks)

Characteristic features and examples of different phyla (Porifera, Coelenterate, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca Echinodermata, Chordate)

PART VI – MATHEMATICS – 07 MARKS

1. Sets (Type of sets, subset, set operations etc .)
2. Relations (Type of relations ,Number of relations from a set A to B etc.)
3. Functions (Type of functions ,Domain and range etc.)
4. Factorial of numbers (Position of a word ,Number of arrangements etc.)
5. Progression(Arithmetic Progression ,Geometric progression)
6. Trigonometry (Questions based on standard results and values)
7. Conic (Latus rectum ,eccentricity ,focus etc. of ellipse ,Parabola)
8. Vector (Perpendicular vector ,Parallel vector ,dot product)
9. Derivatives (Derivatives of some standard functions)
10. Straight Line (slope ,intercept etc.)

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.

****