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તા.૨૬-૦૯-૨૦૨૫નાં No.: GAD/NT/GIA/Emp.Notice/25862/2025 **ટેકનીકલ આસિસ્ટન્ટ (બાયોસાયન્સ)** સંવર્ગની સ્પર્ધાત્મક પરીક્ષા સંદર્ભે Detailed અભ્યાસક્રમની અગત્યની સૂચના

ટેકનીકલ આસિસ્ટન્ટ (બાયોસાયન્સ) માટે સંબંધિત વિષય અને તેની ઉપયોગીતા અંગેના પ્રશ્નો:

PART: B **(150 MARKS)**

1. Evolution

- Introduction, Concepts of Origin of Life, Theories of Organic Evolution, Theories of Inheritance of Acquired Characters (Lamarckism), Theories of Natural Selection, Mutation Theory and Synthetic Theory, Speciation and Isolating Mechanisms, Morphological Criteria for Species and Race, Allopatric and Sympatric Populations, Isolating Mechanisms

2. Plant Kingdom

- General Characters of Plants, Body Organization: Root, Stem, Leaves, Tissues: Dermal, Vascular, Ground

3. Structure of Cell

- Chemistry and Ultrastructure of Cell Wall, Cell Membrane, Flagella & Cilia Organelles Mitochondria, Chloroplast, Golgi Bodies, Peroxisome, Endoplasmic Reticulum, Ribosome

4. Fundamentals of Biology

- General Characteristics, Classification and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms
- **Angiosperms** :Principle of classification and nomenclature of angiosperms, Anatomy of angiosperms, Structure and development of anthers and ovules, fertilization, seed development, seed dormancy and germination
- **Non-Chordates** : General Characteristics , Classification and economic importance of Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata
- **Chordates** : General Characteristics , Classification and economic importance of Protochordata, Hemichordata, Urochordata, Cephalochordata, Cyclostomata Amphibia, Reptilia, Aves, Mammalia

5. Biochemistry

- **Carbohydrates**: Classification, Structure aspects- Introduction & Occurrence, Classification of Mono-Di and Polysaccharides, Reducing & Non-reducing Sugar, Constitution of Glucose & Fructose, Osazone formation, Pyranose & Furanose forms, Determination of ring Size, Inter-conversion of monosaccharides

- Lipids: Structural aspects General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, Membrane protein - structural aspects, Lipoproteins.
- Proteins: Structural aspects General introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins.
- Nucleic acid: Structural aspects Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.
- Chemical & Enzymatic Kinetics: An introduction to enzyme; How enzyme works; Reaction rate; Thermodynamic definitions; Principles of catalytic power and specificity of enzymes; Enzyme kinetics- Approach to mechanism.
- Mutation: Occurrence, kinds of Mutation, spontaneous & induced Mutation, Mutagens, detection of Mutation, Lethal Mutations, Biochemical Mutations, Phenotypic effects of Mutation, Molecular basis of Mutation, Significance & Practical applications of Mutation.
- Expression of genetic information: from Transcription to Translation, the Relationship between genes and protein, the transcriptions: The basic process, Transcription and RNA Processing in Eukaryotic Cells, encoding genetic information, Decoding the codons: the role of transfer RNAS.
- Regulation of mRNA stability: capping, polyadenylation, pre-mRNA splicing, information of commitment complex, creation of catalytic sites, trans-esterificationreactions, mRNA surveillance.

6. Organic Mechanisms in Biology:

- Common Mechanisms in Biological Chemistry- Overview of Digestion, Absorption, Metabolism (Anabolism & Catabolism), Nutrition, Photosynthesis, Respiration, Excretion.

Biomolecules:

- Carbohydrates (Anomaric carbon, Simple Chemical of Glucose, Reducing & Non-reducing Sucrose, Maltose & Lactose, Elementary idea of structure of Starch & Cellulose); Proteins (Denaturation of proteins, Enzyme Kinetics), Nucleic acids (Mechanisms of Replication, Transcription & Protein synthesis, Genetic code); Hormones (classification, structural features & functions in bio-systems); Vitamins (classification, functions of vitamins in bio-systems).
- Carbohydrate Metabolism Aerobic & Anaerobic glycolysas, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle, glycogenesis, glycogenesis (sequence of reactions & regulation), Pentose-phosphate pathway (sequence of reactions & regulation), extraction of energy from food sources

7. Cellular Metabolism:

- Oxidation-Reduction, Energy and Carbons source utilization, Electron transport chain and ATP generation
- Metabolism: Anabolism, Catabolism, Respiration, Fermentation, Photosynthesis
- Nutrient uptake: Active transport, Passive transport, Facilitated diffusion, Group translocation
- Enzymes: Properties, Mechanism of catalysis, Allosteric controls

8. Cell division:

- Cell division, Phases, Mitosis and Meiosis Growth and Tumor.

9. Current Trends and Recent Advancements in the Above Fields.

10. Laboratory Instruments: Principles, Mechanisms, Operation, Calibration, Applications & Maintenance:

- Advanced Molecular Biology & Analytical Instruments: CO2 Incubator, PCR, RT-PCR/qPCR, NGS, Biofragment Analyzer, AxioScope
- Chromatographic & Spectrometric Instruments: HPLC, HPTLC, GC-MS, LC, Flame Photometer
- Core Laboratory Instruments: Centrifuges, Autoclave, Spectrophotometer

11**. Sample Handling & Lab Techniques**

- Aseptic handling, inoculation, streaking
- DNA/RNA extraction basies
- Gel electrophoresis (agarose & PAGE)
- Media preparation (agar, broth)
- Buffer preparation & pH adjustment
- Filtration (membrane & syringe filter)

12. Computer Skills for Instrument Operation

- Technical Assistants must be able to handle:

A. **Instrument Software**

- PCR, RT-PCR instrument software (ABI, Bio-Rad)
- HPLC/GC-MS data acquisition software
- NGS run setup & monitoring (Illumina/Nanopore platforms)
- Spectrophotometer & Nanodrop software
- Bioanalyzer analysis software

B. **Data Analysis & Reporting**

- Basic bioinformatics (FASTQ, QC awareness)
- Chromatogram interpretation (HPLC, GC-MS)
- qPCR Ct value interpretation
- Graph generation & statistical analysis (Excel, Origin, GraphPad)

C. General Computer Proficiency

- MS Word, Excel, PowerPoint
- Documentation and report preparation
- File formats, data storage & backup
- Basic troubleshooting of software issues

13. Solution Preparation Techniques:

- Molarity (M), Normality (N), Molality (m)
- % w/v, % w/w, % v/v

- Preparation of Buffers
- Serial Dilution & Stock/Sample Preparation
- Standard Solutions & Calibration Curves
- Safe Handling of Acids, Bases, and Volatile Chemicals

14. Good Laboratory Practice:

Essential guidelines for quality and safety in bioscience labs:

A. Documentation & Data Integrity

- ALCOA+ principles (Attributable, Legible, Contemporaneous, Original, Accurate)
- Logbook maintenance (instrument log, autoclave log, media preparation log)
- SOP compliance

B. Laboratory Safety & Hygiene

- Personal Protective Equipment (PPE)
- Hazard symbols (GHS), MSDS handling
- Waste disposal
- Biohazard waste
- Chemical waste
- Sharp waste
- Glass waste

C. Aseptic & Sterile Techniques

- Working in LAF/BSC
- Sterile media preparation
- Sterilization validation
- Aseptic Techniques
- Sterilization Techniques

D. Quality Control & Quality Assurance

- Calibration scheduling
- Preventive maintenance
- Internal audits & external audits (awareness)

E. Sample Handling & Storage

- Labelling standards
- Cold storage (2-8°C, -20°C, -80°C)
- Avoiding contamination & degradation

F. Basic Laboratory Techniques

- Microbial culture techniques (streaking, inoculation, colony counting)
- Media preparation (agar & broth)
- Pipetting techniques (micro-pipettes)
- Filtration (membrane & vacuum)
- Preparation of slides, staining (Gram staining, simple staining)
- Handling glassware & plasticware

G. Bioscience Essentials (Awareness Level for Assistants)

- Basic microbiology concepts
- Basic biochemistry concepts.
- Cell structure fundamentals
- Plant/animal tissue handling basics
- Environmental monitoring (air, surface, water testing)