



INDIAN INSTITUTE OF TECHNOLOGY MADRAS, CHENNAI-600036.

Advertisement No. IITM/R/4/2025 dated 16.04.2025

Syllabus & Scheme of Examination for the post of Junior Technical Superintendent

Stream: Biotechnology

LEVEL-1 MCQ Test

(100 Marks)

PART-A

(30 Marks)

- 1. Quantitative aptitude:** Number systems, simplification, decimals, fractions, LCM, HCF, ratio & proportion, percentage, log and trigonometric functions, solutions of simple equations (linear and quadratic), basic statistics – mean and standard deviation, profit & loss, discount, simple & compound interest, mensuration, time & work, time & distance, tables & graphs.
- 2. Logical reasoning aptitude:** Analogies, similarities, differences, space visualization, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification
- 3. Computer-related aptitude:** Hardware, software, operating systems, basic operations in MS Office - Word, Excel, Powerpoint
- 4. Language aptitude:** Comprehension, vocabulary, basic grammar in English.
- 5. General awareness aptitude:** Current events, general knowledge, Indian history, Indian constitution, basic geography.

PART-B

(70 Marks)

Section A: Translational and Clinical Sciences

1. Molecular and Cellular Mechanisms in Health and Disease

- Cell and organelle structure-function relationships
- Mechanisms of gene expression, regulation, and epigenetics
- DNA/RNA technologies: PCR, qPCR, electrophoresis, blotting, sequencing
- CRISPR and gene editing concepts
- Applications in diagnostics, gene therapy, and personalized medicine

2. Clinical Microbiology and Infectious Diseases

- Bacterial, viral, fungal, and parasitic pathogens of clinical relevance
- Emerging infections: COVID-19, AMR, zoonoses

- Sterile sample collection and transport
- Culture techniques and microbial identification
- Antibiotic susceptibility testing and interpretation

3. Immunopathology and Clinical Immunology

- Immune system components and responses (innate and adaptive)
- Autoimmune, allergic, and immunodeficiency disorders
- Vaccines, monoclonal antibodies, checkpoint inhibitors
- Clinical immunoassays: ELISA, flow cytometry, immunohistochemistry
- Transplantation and tumor immunology

4. Medical Genetics and Genomics

- Mendelian, chromosomal, and multifactorial disorders
- Prenatal and newborn screening, cytogenetics, FISH
- Whole genome and exome sequencing (WGS/WES)
- Inborn errors of metabolism and genetic counseling
- Single-cell and spatial genomics principles (e.g., 10x Genomics platforms)

Section B: Laboratory Methods and Biomedical Instrumentation

5. Clinical Biochemistry and Diagnostics

- Analysis of blood, CSF, urine, and other body fluids
- Biomarkers for organ function (LFT, RFT, cardiac, pancreatic)
- Point-of-care diagnostics and sensors
- Nutritional biochemistry and metabolic panel interpretation
- Enzyme activity assays and standard curves

6. Stem Cell Technology

- Basics of ESCs, iPSCs, MSCs
- Immunostaining, IF/IHC, live/dead assays
- Applications in regenerative medicine and disease modeling
- Biobanking and QC

Section C: Core Facility Equipment and Operations

7. Advanced Microscopy and Bioimaging

- Confocal microscopy (Leica Stellaris DMI8): basic
- Electron microscopy (basic methodology): cryo-fixation, embedding, imaging

8. Flow Cytometry and Cell Sorting

- Principles of flow cytometry
- Sample preparation: fluorochrome labeling, viability dyes

Section D: Laboratory Operations and User Support

9. Facility Management and Compliance

- Standard Operating Procedures (SOPs)
- Sample and reagent inventory systems
- Biosafety, biomedical waste, and ICMR/DBT guidelines

10. Training, Troubleshooting, and User Engagement

- Documenting usage logs, scheduling access
- Initial troubleshooting and service coordination
- Recordkeeping for audits and equipment uptime

Syllabus for Level-2 Trade Test

Section A: Basic Wet Lab Skills

- Pipetting and Dilution Preparation
 - Use of single and multi-channel pipettes
 - Preparing 1:10 and 1:100 dilutions
 - Pipette calibration check using colored solutions
- Sample Handling and Safety
 - Wearing gloves, PPE, and lab coat correctly
 - Proper tube labeling and cryo marker use
 - Color-coded biomedical waste segregation
- Centrifuge Operation
 - Tube balancing before spinning
 - Setting time and RPM
 - Safe start/stop and lid lock protocol
- Buffer Preparation and pH Adjustment
 - Weighing chemicals with digital balance
 - Preparing simple buffers (e.g., PBS)
 - Adjusting pH using NaOH/HCl and pH paper
- Preparation of PBS and FACS Buffer
 - Understanding buffer composition
 - Filtering and labeling reagents for storage

Section B: Equipment Basics

- Brightfield/Light Microscope Handling
 - Identifying microscope parts

- Focusing on pre-stained slides
- Switching objectives and light adjustment
- Confocal Microscopy (Leica Stellaris DMI8) – Familiarity Only
 - Identifying objective turret, sample stage, and laser path
 - Slide mounting with cover slips
- Gel Electrophoresis Setup
 - Casting agarose gel
 - Loading dye into gel wells
 - Correctly connecting power leads and timer setup

Section C: Basic Genomics And Flow Workflows

- Use of Hemocytometer or Manual Cell Counter
 - Preparing mock sample (colored beads or dye)
 - Loading onto hemocytometer
 - Viewing and locating grid under microscope
- DNA Isolation Awareness
 - Understanding steps in spin-column DNA extraction
 - Identifying reagents and their functions
 - Assembling a scrambled SOP correctly
- Flow Cytometry Sample Prep (Mock Demo)
 - Transferring mock sample to FACS tube
 - Adding simulated antibody solution
 - Filtering through cell strainer cap
 - Labeling and documenting sample ID

Section D: Documentation And Logbook Tasks

- Instrument Logbook Entry
 - Filling usage details including:
 - - Date and time
 - - Equipment name
 - - Task performed
 - - Comments or issues
- SOP Interpretation and Compliance
 - Rearranging a short SOP in correct step order
 - Identifying missing safety steps
- Safety and Waste Handling Quiz
 - Matching common lab disposables to proper waste bins
 - Selecting appropriate PPE for sample handling

Scheme of Examination:

Level	Type of Test	Time	Max. Marks	Weightage for the final result
Level -1	Computer Based MCQ Test (100 Questions)	Time: 120 Minutes	100 Marks	70 %
Level-2	Trade Test	Time: 90 minutes approximately	Practical Trade Test	30 %

- A minimum of 5X candidates shall be shortlisted (for X number of posts advertised) for the Level-2 Trade Test, based on their performance in the Level-1 Multiple Choice Question Test.

NOTE:

- a) The medium of examination will be ENGLISH
 - b) The questions will generally be on the minimum qualification level i.e. Graduation.
 - c) There shall be no negative marking for wrong answers.
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