

Faculty of Interdisciplinary Studies in Medical Biotechnology

PART A – Research Methodology (Q.1–35)

1. Foundations of Research & Ethics

- Purpose, characteristics of scientific research
- Theory vs. hypothesis; constructs & variables
- Research integrity, consent, confidentiality, plagiarism

2. Research Problems, Hypotheses & Variables

- Problem identification/formulation
- Working, null & alternate hypotheses
- Independent, dependent & confounding variables
- Type I/II errors, p-values & confidence intervals

3. Designs, Sampling & Blinding

- Observational: cross-sectional, case-control, cohort
- Experimental: RCTs, randomization & control, blinding
- Sampling: simple random, stratified, cluster, systematic; purposive/convenience
- Sample size & bias

4. Measurement, Tools & Data Quality

- Scales: nominal, ordinal, interval, ratio
- Questionnaires, interviews, observation, Likert scales
- Reliability & validity

5. Descriptive Statistics & Graphics

- Central tendency: mean, median, mode
- Dispersion: range, IQR, variance, SD
- Normal vs. skewed distributions
- Graphs: bar charts, histograms, scatter/box plots

6. Inferential Statistics

- t-test, chi-square, ANOVA
- Correlation & regression
- Non-parametric tests – Mann-Whitney, Kruskal–Wallis

7. Epidemiology & Public Health Measures

- Incidence, prevalence
- Sensitivity, specificity, predictive values
- Screening principles, herd immunity
- Cold-chain (2–8 °C); ICD-11
- Global indices – HDI, PQLI, GII, MPI
- Bradford Hill criteria

8. Referencing & Reporting

- Styles: APA, Vancouver, Chicago
- Proposals, theses, dissertations
- Literature review & citation practice

PART B – Medical Biotechnology Subject (Q.36–70)

1. Cell & Molecular Biology

- Cell structure, membranes & transport; endomembrane system; cytoskeleton
- Cell signaling – auto/para/endocrine mechanisms
- DNA replication, repair, transcription & translation
- RNA structure & folding

2. Genetics & Genomic Engineering

- Gene recombination & cloning – restriction enzymes, plasmids
- PCR & genome organization
- Antibody diversity via gene rearrangements
- Mendelian & non-Mendelian inheritance (e.g., X-linked)

3. Biochemistry & Biophysical Chemistry

- Biomolecules & unusual amino acids
- Water properties, buffers, electrolytes
- Carbohydrate/protein/lipid metabolism
- Fermentation & lactate metabolism
- Oxidative stress, lysosomal permeability
- Chromatography & spectroscopy basics

4. Microbiology & Virology

- Bacterial structure & growth
- Antibiotics & mechanisms – DNA gyrase inhibitors
- Medically important viruses (SARS-CoV-2, rotavirus, adenovirus)
- Sterilization & culture fundamentals

5. Immunology & Transplantation

- Innate & adaptive immunity
- HIV targeting CD4⁺ T cells
- Hypersensitivity reactions I–IV
- Autoimmunity & molecular mimicry
- Transplant immunology – rejection types
- Monoclonal antibodies & checkpoint inhibitors

6. Medical Diagnostics & Clinical Biotech

- Diagnostic accuracy – sensitivity, specificity, predictive values
- Immunodiagnostics
- Clinical chemistry & biomarkers
- Vaccinology & cold-chain
- Biosafety & quality concepts

7. Bioinstrumentation & Analytical Techniques

- Chromatography – separation principles
- Spectroscopy & photometry basics
- Radiation & radioisotopes – penetration levels
- Lab counters & safety practices

8. Biomedical & Translational Themes

- Neurobiology & behavior
- Metabolic & genetic diseases
- Pharmacological aspects – antimicrobials
- Ethical & regulatory considerations