

# **Syllabus for Licensing Examination of Master of Science Immunology 2022**



**Nepal Health Professional Council**

Bansbari, Kathmandu

## Table of content

S.N.	Topic	Marks
1	Molecular and Cellular Basis of Biomedicine	15%
2	Immunology	25%
3	Molecular Immunology	5%
4	Serology and Cellular Immunology Techniques	25%
5	Stem Cell Science	5%
6	Advanced Flow Cytometry	5%
7	Molecular Biology Techniques	10%
8	Biostatistics	5%
9	Generic skills in science research	5%
	Total	100%

## 1. Molecular and Cellular Basis of Biomedicine issues

- ◆ Biomolecules
- ◆ Cell structure and function
- ◆ Genetic materials, regulation of gene expression
- ◆ Structure and mechanism of enzyme
- ◆ Membrane biology
- ◆ Cell communication
- ◆ Cell signaling
- ◆ Energy
- ◆ Metabolism
- ◆ Cell proliferation, cell differentiation
- ◆ Cell death
- ◆ Cancer, basic immune response, host pathogen interaction
- ◆ Basic gene, protein, cellular and immunological methods in biomedical research

## 2. Immunology issues

- ◆ Cells and organs of the immune system
- ◆ Principles of the immune responses
- ◆ Cellular components and development of the immune system
- ◆ Leukocyte Circulation and Migration into Tissues
- ◆ Cell -associated pattern recognition receptors and sensor of innate immunity.
- ◆ The Major Histocompatibility Complex
- ◆ The processing of protein antigen
- ◆ Antigen recognition
- ◆ Costimulatory Receptor Signaling in T Cells
- ◆ B lymphocyte antigen receptors
- ◆ Cytokine receptors and signaling
- ◆ Cell-mediated and humoral immune responses
- ◆ Innate and adaptive immune responses
- ◆ Activation of B lymphocytes
- ◆ Activation of T lymphocyte
- ◆ The Complement system
- ◆ Immunity to infections
- ◆ Immunity to tumors
- ◆ Immunological memory
- ◆ Vaccine immunology
- ◆ Physiological and pathological mechanisms of immune responses

- ◆ Regulations of the immune responses.
- ◆ T lymphocyte and B lymphocyte tolerance
- ◆ Roles and significance of factors affecting the immune responses; Self-study
- ◆ Analytical thinking
- ◆ Discipline and punctuality; Morality and ethics

### 3. Molecular Immunology issues

- ◆ Components and functions of the innate and adaptive immune system at both cellular and molecular levels
- ◆ Development and differentiation of major subpopulations of lymphocyte.
- ◆ Antigen presentation through classical and non-classical MHC molecules; Tolerance of immune system.
- ◆ Autoimmunity; Mucosal immunity

### 4. Serology and Cellular Immunology Techniques issues

- ◆ Principles, procedures, and interpretation of Immunology laboratory investigation.
- ◆ Flow cytometry
- ◆ Detection of immunoglobulin level
- ◆ Immuno-electrophoresis
- ◆ Phagocytic function
- ◆ Lymphoproliferation assay
- ◆ Agglutination test
- ◆ Immunofluorescence.
- ◆ Automated immunoassays
- ◆ Techniques for diagnosis and research in immunology

### 5. Biostatistics issues

- ◆ Scientific methods and biostatistical analysis
- ◆ Statistical principles to applying in planning and analyzing data from experiment
- ◆ Probability distributions
- ◆ Estimation
- ◆ hypothesis testing
- ◆ Chi-square test and analysis of frequencies
- ◆ regression and correlation analysis
- ◆ analysis of variance
- ◆ analysis of covariance

## 6. Stem Cell Science issues

- ◆ Comprehensive view of the stem cell biology
- ◆ Biology of both embryonic and adult stem cells
- ◆ Characteristics at cellular and molecular levels
- ◆ Signaling transduction; Stem cell interactions with their microenvironment; Stem cell role in tissue and organ homeostasis
- ◆ Basic techniques in stem cell research
- ◆ Hematopoietic stem cell transplantation as a standard treatment for hematological disorders
- ◆ Potential uses and limitations of stem cells for the treatment of diseases
- ◆ Ethical issues of stem cell for research, animal care and clinical practice

## 7. Advanced Flow Cytometry issues

- ◆ Introduction to flow cytometry technique
- ◆ Compensation in flow cytometry and fluorochrome selection
- ◆ Flow cytometric data analysis
- ◆ Polychromatic flow cytometry for multi-parameter analysis
- ◆ Cell sorting for specific cell subset isolation; Advanced flow cytometry technique for research

## 8. Molecular Biology Techniques issues

- ◆ Principle of molecular biology techniques
- ◆ procedure and laboratory skill on molecular biology techniques
- ◆ DNA and RNA extraction and analysis; Polymerase chain reaction
- ◆ Gene mutation analysis
- ◆ Bacterial DNA vector preparation
- ◆ Genetic engineering
- ◆ Gene cloning
- ◆ Cell culture technique
- ◆ Gene mutagenesis
- ◆ Recombinant protein production
- ◆ Protein separation and analysis
- ◆ Protein expression in cell culture
- ◆ Cellular analysis

## 9. Generic Skills in Science Research issues

- ◆ Ethics for researchers
- ◆ Ethical consideration in the use of ideas
- ◆ Human subjects and experimental animals
- ◆ Bio and fire safety in the laboratory
- ◆ Proper design and use of research protocols
- ◆ Methods in search for scientific information
- ◆ Techniques in formulating and writing research projects, i.e., thesis proposals and grant applications, research reports, theses, and manuscripts for publication Intellectual property right
- ◆ Copyright versus plagiarism; Proper credit acknowledgement