

## **Molecular Medicine: Concepts and Applications (MMD-890)**

**Credit Hours 3 (3-0)**

### **Course Description**

The emerging field of molecular medicine provides deeper understanding of diseases and offers opportunities for designing rational therapies. “Introduction to Molecular Medicine” is designed to introduce students to topics in human health and disease from a molecular biology perspective. Basic principles that promote an understanding of the human genome, gene regulation and expression, and genetic engineering will be applied to the diagnosis and treatment of human disease.

### **Educational Objectives**

Upon completion of the course the student should be able to:

- Acquire a broad understanding of current molecular genetics and genomics including current areas of research and research methodologies.
- Learn to identify important outstanding problems in molecular genetics and genomics and to plan research to address these problems.
- Learn molecular understanding of how normal cellular processes change, fail or are destroyed by disease.

### **Course Contents**

1. Organization of the Human Genome, Chromosomes, and Genes
2. Genes, Environment and Inheritance
  - Mendelian Genetic Inheritance
  - Complex Genetic Inheritance
  - Epigenetic Inheritance
  - Somatic Cell Genetics
3. Transcriptional Control of Gene Expression
  - Control in Higher Eukaryotes
4. Transmission of Human Genetic Disease
  - Disease mechanisms and development
  - Models of Human Diseases
5. Molecular Diagnostic Testing

- Introduction
  - DNA Variants
  - Detecting DNA Variants (Biomarker Discovery)
  - Calculating Risk
  - DNA Genetic Tests
  - Evaluation
  - Challenges
  - SARS-CoV-2 detection
6. Genetic Counseling
- Role of Genetic Counselors
7. Bio banks and Health Registries
8. Tailored and Personalized Medicine
9. Ethical, Legal and Social Implications
- Introduction
  - Consent
  - DNA Genetic Tests
  - Oversight
  - Challenges Ahead
10. Omics
- Introduction
  - DNA Sequencing
  - DNA Microarrays
  - Bioinformatics
  - Other Omics
  - Systems Biology
11. Computational Biology
- Structure-based Drug discovery
  - Drug Targeting
12. Molecular and Cellular Therapies
- Introduction
  - Recombinant DNA Products

- Gene Transfer
- Regenerative Medicine
- Other Therapies

### **Recommended Books**

1. Kurreck, J., & Stein, C. A. (2015). *Molecular medicine: an introduction*. John Wiley & Sons.
2. Trent, R. J. (2012). *Molecular Medicine-Genomics to Personalized Healthcare*, London uA 4.
3. Runge, M. S., & Patterson, C. (Eds.). (2007). *Principles of molecular medicine*. Springer Science & Business Media.
4. Kresina, T. F. (2001). *An introduction to molecular medicine and gene therapy*. New York; Chichester: Wiley-LISS.