**III.2.3 ADVANCED MOLECULAR BIOLOGY**

1. **Course description:**
2. **Credit points**: 4 ECTS
3. **Time commitment:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Items | Lecture | Tutorial/  Exercise | Practice/  Assignment | Lab-work | **Total** |
| No. of hours | 35 | 2.5 |  | 2.5 | **40** |

1. **Prerequisites**: Cell Biology, Biochemistry, Molecular Biology, Principles of Immunology
2. **Recommended background knowledge**: Physiology, Microbiology, Cell Biology.
3. **Subject description:**

Molecular biology is the study of nucleic acids, proteins and how these molecules interact to control cellular activities such as growth, division, and development. This course will emphasize on the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in prokaryotes and eukaryotes. The students will be introduced to advanced tools of molecular biology that have been used to understand these mechanisms such as bioinformatics, PCR technology, genomics, transcriptomics, proteomics, metabolomics, and cloning technology...

1. **Objectives & Outcome**

Students will gain knowledge of the principles of molecular biology, advanced technologies and how to apply them in biotechnology. The knowledge will be exemplified and applied through exercises. The students will perform the loop-mediated isothermal amplification (LAMP) for pathogenic bacteria detection in Tilapia

1. **Assessment/ Evaluation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Component | Attendance | Exercises | Report | Practical | Midterm | Final |
| Percentage % | 10 | 40 |  |  |  | 50 |

1. **Prescribed Textbook(s)**

**II. Course content & schedule:**

1 Genotype to phenotype

- Brush up your knowledge about

o Nucleic acid structure

o Transcription

o Translation

2 Techniques of molecular biology

- Mutants and Genome mapping

- Molecular cloning methods

- Molecular tools for studying genes and gene activity

3 Transcription in bacteria

- Mechanism of transcription in bacteria

- Operons

- Major shifts in bacterial Transcription

- DNA-protein interactions in bacteria

Transcription in eukaryotes

- Eukaryotic RNA polymerases and their promoters

- General transcription factors in eukaryotes

- Transcription activators in eukaryotes

- Chromatin structure and its effects on transcription

Posttranscriptional events

- Messenger RNA processing I: Splicing

- Messenger RNA processing II: Capping and polyadenylation

- Other RNA processing events

DNA replication, recombination and transposition

4 Translation

- The mechanism of translation

- Ribosomes and transfer RNA

5 Protein structure and function

6 Genome analysis and systems biology

- High throughput methods

o Transcriptomics

o Proteomics

o Metabolomics

7 Metabolic engineering and synthetic biology

8 Web-based sequence analysis

- How to design primer for PCR

- How to design primers targeting a specific gene by LAMP PCR

9 LAMP PCR detection of the pathogenic bacteria in Tilapia

- Setting up a LAMP PCR reaction

- Color detection/gel electrophoresis

1. **Reference Literature:**

[1]. Molecular Biology, Robert F. Weaver. McGraw-Hill International 2008

[2]. The Cell: A Molecular Approach, Sixth Edition Copyright 2013 by Geoffrey M. Cooper.

[3]. Microbial Genetics SCBT 302 Mahidol University