Course Objectives (Intended Learning Outcome):
After completion of the course, students are expected to be able to
1. Comprehend the knowledge, theories and principles of protein structure, functions, regulation and biological processes.
2. Describe the most up-to-date methods (including X-ray crystallography and cryo-EM) utilized to characterize protein structures at atomic resolution.
3. Describe the history and scientific thinking behind the discoveries of biological principles and theories.
4. Utilize the strategies, ideas and methodologies used in current biological research.
5. Self-study biological topics related to proteins
6. Appreciate biological sciences and research

Course Contents:
I. Chemical and physical characterization of proteins
II. Secondary and tertiary structures of proteins
III. Chemical modification of proteins
IV. Post-translational modification of proteins
V. Protein purification
VI. Protein structure prediction
VII. Protein structural determination (X-ray crystallography and cryo-EM)
VIII. Tools to analyze protein sequence and structures
IX. Structural and function of membrane proteins
X. Protein and diseases

Exams and Grading:
Mid-term examination (30%), Final Examination (30%), Homework or Presentation (40%)
Grading A+ to F
Course Topics and Schedule:

I. Chemical and physical characterization of proteins
   Properties of amino acids, peptides, and proteins (Textbook Chapter 1)

II. Secondary and tertiary structures of proteins
   Protein folding patterns (Textbook Chapter 5, 6.4)
   Protein modules
   How to keep a protein folded properly (Textbook Chapter 4)

III. Chemical modification of proteins
   Methods and applications

IV. Post-translational modification of proteins
   Structural and functional effects (Textbook Section 2.4)
   Methods for detection of protein PTM

V. Protein purification
   Methods for protein expression and purification
   Methods for characterization of protein
   Methods for evaluation of protein behavior

VI. Protein structure predication
   Secondary protein structure predication
   Tertiary Protein structure predication

VII. Protein structural determination (X-ray crystallography and cryo-EM)
   X-ray crystallography (Textbook Chapter 10.1, 10.3)
   Resolution revolution of cryo-EM (Textbook Chapter 10.5)

VIII. Tools to analyze protein sequence and structures
   Protein sequence analysis (Textbook Chapter 6.3)
   Protein structural visualization and analysis (Textbook Chapter 6.6)

IX. Structural and function of membrane proteins
   Physiological functions of membrane proteins (Textbook Chapter 5)
   Structural and mechanistic studies of membrane proteins

X. Protein and diseases
   Relationship of protein and diseases (Textbook Chapter 12)
   Structural based drug development