

**International Master's Programs of Chemical Engineering in the Graduate School of Engineering,  
Kyushu University (Academic Year from October, 2025)**

Subject: Fundamentals of Bioengineering (1 sheet)

1. (26 points)

Answer the following questions.

- (1.1) Explain the complementary DNA (cDNA).
  
- (1.2) Describe the name of the polymer that is the main component of plant cell walls, and the type of bond between its monomers.
  
- (1.3) Compare the characteristics of *Escherichia coli* (*E. coli*) and animal cells as hosts for recombinant protein production.

2. (24 points)

Answer the following questions.

- (2.1) Answer the difference between the ratio of proteins to lipids in the plasma membrane of prokaryotic and eukaryotic cells. Explain the reason for this difference based on the structure and function of each cell.
  
- (2.2) Explain the function of the following enzymes in DNA replication.
  - (a) DNA helicase
  - (b) DNA primase
  - (c) DNA polymerase
  - (d) DNA ligase