※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

Part A: (50%)

I. (10%) Please pick up the best type of microscope from (A) to (H) for each experiment.

(A) Bright-field microscope	(B) Confocal microscope	(C) Differential interference contrast microscope
(D) Fluorescence microscope	(E) Scanning electron microscope	(F) Transmission electron microscope
(G) Dark-field microscope	(H) Cryogenic electron microscope	

(1) After endospore staining (2) To observe the shape of a bacteriophage (3) To observe vacuoles within a live cell. (4) To observe 3D structures of biofilm formed by GFP-tagged bacteria on roots (5) To gain high-resolution structures of protein complexes

II. (5 %) Please explain the reason why a synergistic effect can be observed when aminoglycoside antibiotics are used with β-lactam agents on the basis of their modes of action.

III. (10%) (1) Why do people usually say that "Gram-negative bacteria evolve more types of protein secretion systems than Gram-positives due to the complexity of their cell wall structure"? (4%) (2) Among those protein secretion system, type III secretion system is also called injectisome. Why and what is the general functions of this secretion system? (4%) (3) chaperones are sometimes required for translocation of a secreted protein. What is a chaperone? (2%)

IV. (6%) A cloning vector possesses three essential features including original of replication, selectable marker, and a multiple cloning site or a polylinker. Why are these three features so important for a cloning vector?

V. (10%) Please define (1) auxotroph (2) prototroph (3) Photolithoautotroph (4) Chemoorganoheterotroph (5) psychrotroph

VI. (9%) Please design an experiment using a selective medium to isolate a particular microorganism. In this experimental design, please provide (1) the objective of your experiment, (2) which microorganism you want to isolate, (3) which selective medium you choose and (4) why this medium can be used to isolate the microorganism you choose.

Part B: (50%)

I. Vaccine is an important method for protecting the host from the future infection of microorganisms, describe the characteristics of

(1) Whole cell vaccine, (2) Acellular (or Subunit) vaccines and (3) Recombinant (or DNA) vaccines, also please include their potential problems (6%) As well, what is the **reverse vaccinology** (2%)

II. Biofuel production, two materials, H_2 and **ethanol** can be used as biofuels and (1) how could the company produce these two products by using the microorganisms and (2) what are the drawbacks of using these two methods for production of biofuels by microorganisms. (4%)

III. What is the mechanism for the Dengue virus to infect the human beings (including the first infection and the second infection with different dengue-virus types) and it caused the severe effects on the patients who have infected before with different type of Dengue virus. (3%)

IV. What are the purposes of the bacteriocins and the bacterio-phages already known for usage in food preparation, give each an example? (2%) and what are the targets for their functions? (3%)

V. What kinds of virus that SARS belong to, in term of genetic analyses? (1%) Describing the methods that SARS can produce their progeny? (2%) Why does the SARS disappear? (2%)

VI. Describe the following terms: (1) Next-generation nucleotide sequencing (2) Nitrifying bacteria (3) Most probable number (MPN) (4)Secretion system in bacteria (5) Methanogenesis (10%)

VII. Pair (1) to (5) with (a) to (e) : (10%) (1) quorum sensing (2) putrefaction (3) parasporal body (4) orthologue lactone (5) operational taxonomic unit (OUT)(a) breakdown of proteins in anaerobic conditions. (b) gene used as the common one (c) classification of phylogenetic tree (d) N-acyl-homoserine (e) *Bacillus thuringiensis*

VIII. Describe the Mast cells and Macrophage and Dendritic cells in the Immunology (5%)

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