



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

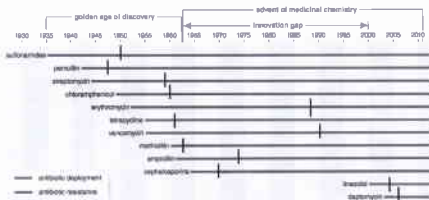
B.Sc. (Special) Degree in Applied Biology
Fourth-Year Semester I Examination – January/February 2021

MIB 4103 – MOLECULAR MICROBIOLOGY

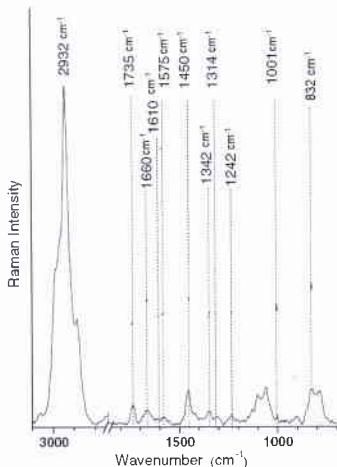
Time: One and half (1 ½) hours

Answer ALL questions.

1. a) Describe briefly, the basic make-up of a bacterial two component system (TCS), with the aid of a diagram. (30 marks)
 - b) Using the *E.coli* osmoregulatory EnvZ TCS as a model, describe the signal transduction cascade taking place in a typical bacterial TCS. (45 marks)
 - c) Describe briefly, the role of cyclic-di-GMP (c-di-GMP) as a bacterial second messenger molecule. (25 marks)
2. a) Discuss briefly, the prevailing molecular mechanisms for the development of antibiotic resistance in bacteria. (65 marks)
 - b) The following graph represents the timelines of bacterial resistance development to several commonly used antibiotics. Each short vertical line in the graph indicates the approximate time of antibiotic resistance emergence. In your opinion, what urgent steps are required to be taken to prevent the newly developed antibiotics from following the same trend? (35 marks)



3. You have recently isolated a novel *Bacillus* sp. that is responsible for putrefaction of cooked rice. You intend to characterize the metabolic capabilities of this novel bacterium using a single-cell microbiological method. At the molecular microbiology laboratory, you were given access to a Raman micro-spectrometer and you were able to obtain the following Raman spectrum from single cells.



Raman peak (cm ⁻¹)	Assignment in cells
832	Polyhydroxybutyrate
1001	Phenylalanine
1242	Lipids
1314	Lipids
1450	Polyhydroxybutyrate
1575	Nucleic acids
1660 and 1610	Amide-I and Amide-III of proteins
1735	Polyhydroxybutyrate
2932	Membrane lipids

- a) Using this Raman spectrum and the provided Raman peak assignment table above, write a description on the metabolic capabilities and other molecular features of the newly isolated bacterium. (80 marks)
- b) State other single-cell microbiological methods that can be used to further characterize this new isolate? (20 marks)

—END—