UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2013/2014

June 2014

BMT 203/3 – Microbial Genetics
[Genetik Mikrob]

Duration: 3 hours
[Masa: 3 jam]

Please ensure that this examination paper contains SIX printed pages before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi ENAM muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **FIVE** (5) out of **SIX** (6) questions, in English or Bahasa Malaysia. Each question carries 20 marks.

*[**Arahan:** Jawab **LIMA** (5) daripada **ENAM** (6) soalan yang diberikan dalam Bahasa Inggeris atau Bahasa Malaysia. Tiap-tiap soalan bernilai 20 markah.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

1. Describe the function of the following genes and the resultant effect if they are mutated.

   [Terangkan fungsi gen tersebut serta akibatnya jika dimutasikan.]

   recA

   mutD

   dnaQ

   Chi sequence (χ)

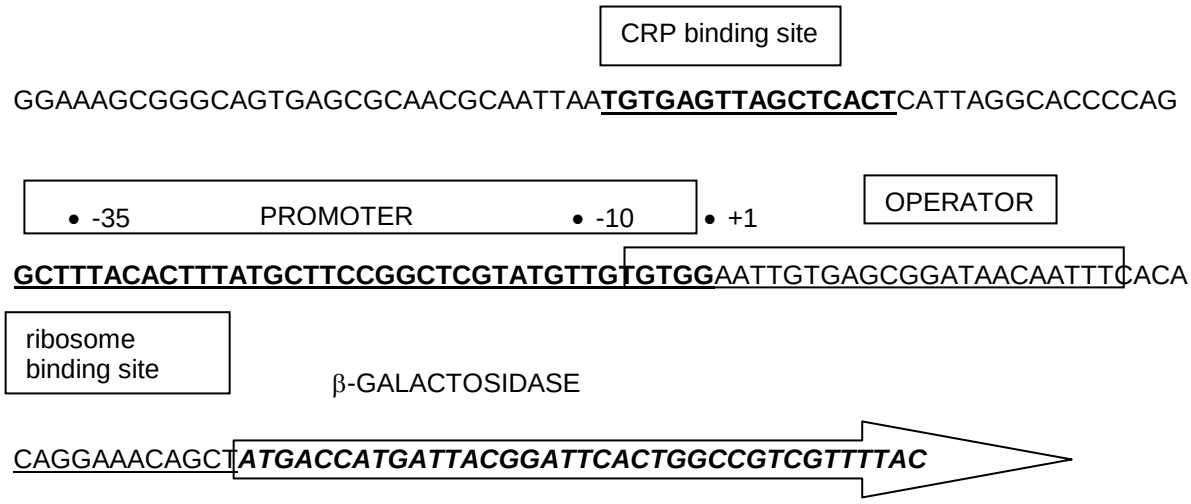
   [jujukan Chi (χ)]

   lexA

   (20 marks / 20 markah)

2. The following diagram is the upstream sequence of the *Escherichia coli* lactose operon containing the important regions of regulation.

   [Gambar rajah berikut adalah jujukan hulu operon laktosa Escherichia coli yang mengandungi kawasan pengawalaturan penting.]



[a] What will happen if the order of the promoter and operator is changed so that the operator is upstream of the promoter?

[Apakah akan berlaku jika aturan promoter dan operator diubah supaya operator berada dihulu promoter ?]

(4 marks / 4 markah)

[b] Which part of the ribosome is complementary to the ribosome binding site?

[Bahagian ribosom yang manakah berkomplementari dengan jujukan tapak pengenalan ribosom?]

(4 marks / 4 markah)

[c] What will happen if the operator sequence undergoes a deletion mutation ?

[Apakah akan berlaku jika jujukan operator mengalami mutasi pemotongan ?]

(2 marks / 2 markah)

[d] What will happen if the operator is moved from its normal upstream location in the operon to between the first and second genes of the lactose operon?

[Apakah akan berlaku jika operator dipindahkan dari lokasi biasanya di hulu operon ke antara gen pertama dan kedua operon laktosa.]

(4 marks / 4 markah)

[e] Explain the role of the catabolite repressor protein (CRP) binding site.

[Terangkan peranan tapak pengikatan protein penindas katabolit (CRP).]

(2 marks / 2 markah)

[f] Explain in detail what will happen to the regulation of the lactose operon if there is a mutation in the catabolite repressor protein (CRP) binding site.

[Terangkan secara terperinci apa akan berlaku terhadap pengawalaturan operon laktosa jika ada mutasi pada tapak pengikatan protein penindas katabolit (CRP).]

(4 marks / 4 markah)

3 [a] *Genetic diversity* refers to any variation in the nucleotides, genes, chromosomes, or whole genomes of organisms. Describe the mechanisms of the generation of diversity from a genetics point of view.

[Kepelbagaian genetik merujuk kepada variasi dalam nukleotida, gen, kromosom atau seluruh genom organism. Terangkan mekanisme penjanaan kepelbagaian dari sudut genetik.]

(12 marks / 12 markah)

[b] Determine the genetic distance and gene order from the results of the transduction experiment below :

[Tentukan jarak genetik dan tertib gen daripada keputusan eksperimen transduksi berikut :]

Donor: smm^R leu^- ace^+

[Penderma: smm^R leu^- ace^+ *]*

Recipient: smm^S leu^+ ace^-

[Penerima: smm^S leu^+ ace^- *]*

Smm^R	Leu^-	Ace^+	675
Smm^R	Leu^-	Ace^-	8
Smm^R	Leu^+	Ace^+	67
Smm^R	Leu^+	Ace^-	90

(8 marks / 8 markah)

4 [a] With the aid of labelled diagrams, explain in detail how the concentration of the amino acid tryptophan regulate the tryptophan operon.

[Dengan bantuan gambar rajah terlabel, terangkan secara terperinci bagaimana kepekatan asid amino triptofan mengawal operon triptofan.]

(12 marks / 12 markah)

[b] What would be the effect on regulation of the Trp operon if every Trp codon in the leader peptide coding region is changed to a stop codon?

[Apakah kesan terhadap pengawalaturan operon Trp jika jujukan setiap kodon Trp dalam kawasan pengkodan peptida pemimpin diubah kepada kodon penamat ?]

(2 marks / 2 markah)

[c] What will happen if every Trp codon in the leader peptide coding region is replaced with a Leu codon ?

[Apa akan berlaku jika setiap kodon Trp dalam kawasan pengkodan peptida pemimpin diubah kepada kodon Leu ?]

(2 marks / 2 markah)

[d] What will be the effect if *trpR* is replaced with *lacI* ?

[Apakah kesan jika gen trpR diganti dengan lacI ?]

(2 marks / 2 markah)

[e] What will happen if the operator is deleted ?

[Apa akan berlaku jika operator dipotong ?]

(2 marks / 2 markah)

5. [a] Bacteriophage and cellular proteins are responsible for the initiation of the lysogenic state of bacteriophage lambda. Describe the steps of this event.
[Protein bakteriofaj dan sel bertanggungjawab dalam pemulaan keadaan lisogeni bakteriofaj lambda. Terangkan semua langkah dalam acara ini.]

(10 marks / 10 markah)

[b] Describe the mechanism responsible for reversion from the lysogenic state to the lytic cycle of bacteriophage lambda when the lysogen is challenged with UV radiation ?

[Terangkan mekanisme yang bertanggungjawab dalam pembalikan daripada keadaan lisogeni kepada kitar lisis yang aktif dalam bakteriofaj lambda apabila lisogen didedahkan dengan sinaran UV.]

(10 marks / 10 markah)

6. [a] Describe the phenomenon of non-coding RNAs and its role in the microbial cell.

[Terangkan fenomena RNA tak-mengkod dan peranannya dalam sel mikrob.]

(10 marks / 10 markah)

[b] The genome of *Salmonella enteric* Typhi which is responsible for typhoid fever has been sequenced. Discuss how this knowledge can lead to new strategies to fight this disease.

[Genom bakteria Salmonella enteric Typhi yang menyebabkan penyakit demam kepialu telah dijujuk. Bincangkan bagaimana pengetahuan baru ini boleh menuju kepada strategi baru untuk melawan penyakit ini.]

(10 marks / 10 markah)