Second Semester Examination
2022/2023 Academic Session

July/August 2023

BTT306 – Techniques in Biotechnology
(Teknik dalam Bioteknologi)

Duration : 2 hours
(Masa : 2 jam)

Please ensure that this examination paper consists of FIVE (5) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA (5) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **FOUR (4)** out of **FIVE (5)** questions, in English or Bahasa Malaysia. Each question carries 25 marks.

*[**Arahan**: Jawab **EMPAT (4)** daripada **LIMA (5)** soalan yang diberikan dalam Bahasa Inggeris atau Bahasa Malaysia. Tiap-tiap soalan bernilai 25 markah.]*

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

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

1. [a] You want to study a mutation in a DLG3 gene and how it relates to memory. Outline the steps and software to design the primer.
[Anda mahu mengkaji tentang mutasi di dalam gen DLG3 dan bagaimana ia berkait dengan memori. Rangkakan langkah dan perisian untuk mereka bentuk primer.]

(10 marks / 10 markah)

[b] Determine the steps of gene amplification using polymerase chain reaction (PCR).
[Tentukan langkah amplifikasi gen menggunakan tindak balas berantai polimerase (PCR).]

(15 marks / 15 markah)

2. [a] DNA vector is critical for recombinant DNA experiment. Describe the key components found in a vector and its function in a vector.
[Vektor DNA adalah penting untuk eksperimen DNA rekombinan. Huraikan komponen utama yang terdapat dalam vektor dan fungsinya dalam vektor.]

(10 mark / 10 markah)

[b] The template strand of a gene contains the sequence 3'-TACTTGTCCGATATC-5'. Illustrate the double-stranded DNA, the resulting mRNA and the amino acid sequence it encodes using Table 1. Determine the differences between the DNA and mRNA sequences.
[Templat jujukan bagi suatu gen mengandungi jujukan 3'-TACTTGTCCGATATC-5'. Ilustrasikan jujukan ganda dua DNA, hasil mRNA dan jujukan amino asid yang dikodkan dengan menggunakan Jadual 1. Tentukan perbezaan antara jujukan DNA dan mRNA.]

First mRNA base (5' end of codon)	Second mRNA base: U	Second mRNA base: C	Second mRNA base: A	Second mRNA base: G	Third mRNA base (3' end of codon)
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A
	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met or start	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

Table 1
[Jadual 1]

(5 marks / 5 markah)

[c] Gene cloning is a process that produces many copies of a gene of interest. Outline the process of gene cloning including the process of selecting clones of cells carrying recombinant plasmid.
[Pengklonan gen ialah satu proses yang menghasilkan banyak salinan gen berkepentingan. Rangkakan proses pengklonan gen termasuk proses pemilihan gen yang membawa plasmid rekombinan.]

(10 marks / 10 markah)

3. [a] Compare the features of Southern blot and Western blot.
[Bandingkan ciri Southern blot dan Western blot.]

(10 marks / 10 markah)

[b] Western blot is a method used to detect proteins by using a probe like an antibody. Using the data in Table 2, draw a Western blot analysis based on the ladder in Figure 1
[Western blot adalah kaedah yang digunakan untuk mengesan protein dengan menggunakan probe seperti antibodi. Dengan menggunakan data dalam Jadual 2, lukiskan analisis Western blot berdasarkan penanda dalam Gambar rajah 1.

Lane *[Lorong]*	Protein	Sequence length (amino acids) *[Panjang jujukan (asid amino)]*	Molecular Weight (kDa) *[Berat Molekul]*
1	A	250	30
2	B	480	65
3	C	140	18
4	D	600	120
5	E	500	85

Table 2
[Jadual 2]

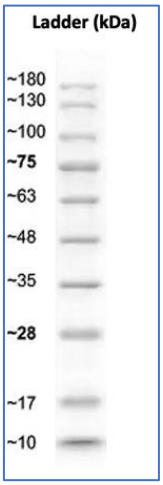

Figure 1
[Gambar rajah 1]

(10 marks / 10 markah)

[c] Illustrate the scheme for an immunoblotting process of a target protein.
[Ilustrasikan skema untuk proses imunoblotting protein sasaran.]

(5 marks / 5 markah)

4. [a] Explain the principle process of a falling film evaporator that is widely used in the food manufacturing industry.
[Terangkan proses prinsip penyejat filem jatuh yang digunakan secara meluas dalam industri pembuatan makanan.]

(10 marks / 10 markah)

[b] Outline the double replacement reactions occur during the precipitation in protein recovery process.
[Rangkakan tindak balas penggantian berganda yang berlaku semasa pemendakan dalam proses pemulihan protein.

(15 marks / 15 markah)

5. [a] Discuss the advantages of reverse osmosis and ultrafiltration for water treatment process.
[Bincangkan kelebihan osmosis berbalik dan kelebihan pengultraturasan bagi proses rawatan air.]

(10 marks / 10 markah)

[b] Analyse the major steps involved in the separation of charged species through chromatography technique.
[Berikan analisis langkah utama yang terlibat dalam pengasingan spesies bercas melalui teknik kromatografi.]

(15 marks / 15 markah)

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