UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER: JULY 2014

TITLE OF PAPER: APPLIED BIOLOGY

COURSE CODE: B405

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

1. THIS PAPER IS DIVIDED INTO FOUR SECTIONS.
2. USE SEPARATE ANSWER BOOKLETS FOR SECTIONs A AND B.
3. ANSWERS TO SECTIONS C AND D SHOULD BE IN ONE BOOKLET.
3. ANSWER A TOTAL OF FOUR QUESTIONS, CHOOSING ONE QUESTION FROM EACH SECTION.
4. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS
5. ILLUSTRATE YOUR ANSWER WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE

SPECIAL REQUIREMENTS: NONE

THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS

SECTION A

Answer one question only from this section

Question 1

Write an essay on "true resistance to plant pathogens". (25 marks)

[Total marks = 25]

Question 2

Demonstrate the use of microorganisms in industrial settings. (25 marks)

[Total marks = 25]

SECTION B

Answer one question only from this section

Question 3

Using *Bactrocera invadens* Drew, Tsuruta and White as an example in Swaziland, explain why alien species become invasive. (25 marks)

[Total marks = 25]

Question 4

Discuss in detail differences between agro-ecosystems and natural ecosystems. (25 marks)

[Total marks = 25]

SECTION C
Answer one question only from this section

Question 5

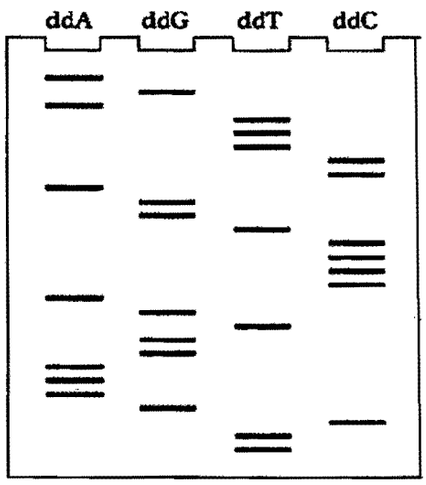
(a) Explain the difference between BLASTP and BLASTN. When would one want to do a BLAST search? (7 marks)

(b) Explain why cDNA for functional genomics studies is made only from mRNA and not also from tRNAs and ribosomal RNAs. Hence explain how mRNA is purified from the rest of cellular RNAs prior to synthesis of cDNA. (18 marks)

Question 6

(a) Evaluate the application of PCR in GMO detection, highlighting the differences amongst event-specific, construct-specific and transgene-specific PCR methods. (10 marks)

(b) A cloned fragment of DNA was sequenced by using the dideoxy chain-termination method. A part of the autoradiogram of the sequencing gel is represented here.



(i). Deduce the nucleotide sequence of the DNA nucleotide chain synthesized from the primer. Label the 5′ and 3′ ends. (5 marks)

(ii). Deduce the nucleotide sequence of the DNA nucleotide chain used as the template strand. Label the 5′ and 3′ ends. (5 marks)

(c) Evaluate the relevance of whole genome sequencing in comparative genomics. (5 marks)

SECTION D
Answer one question only from this section

Question 7

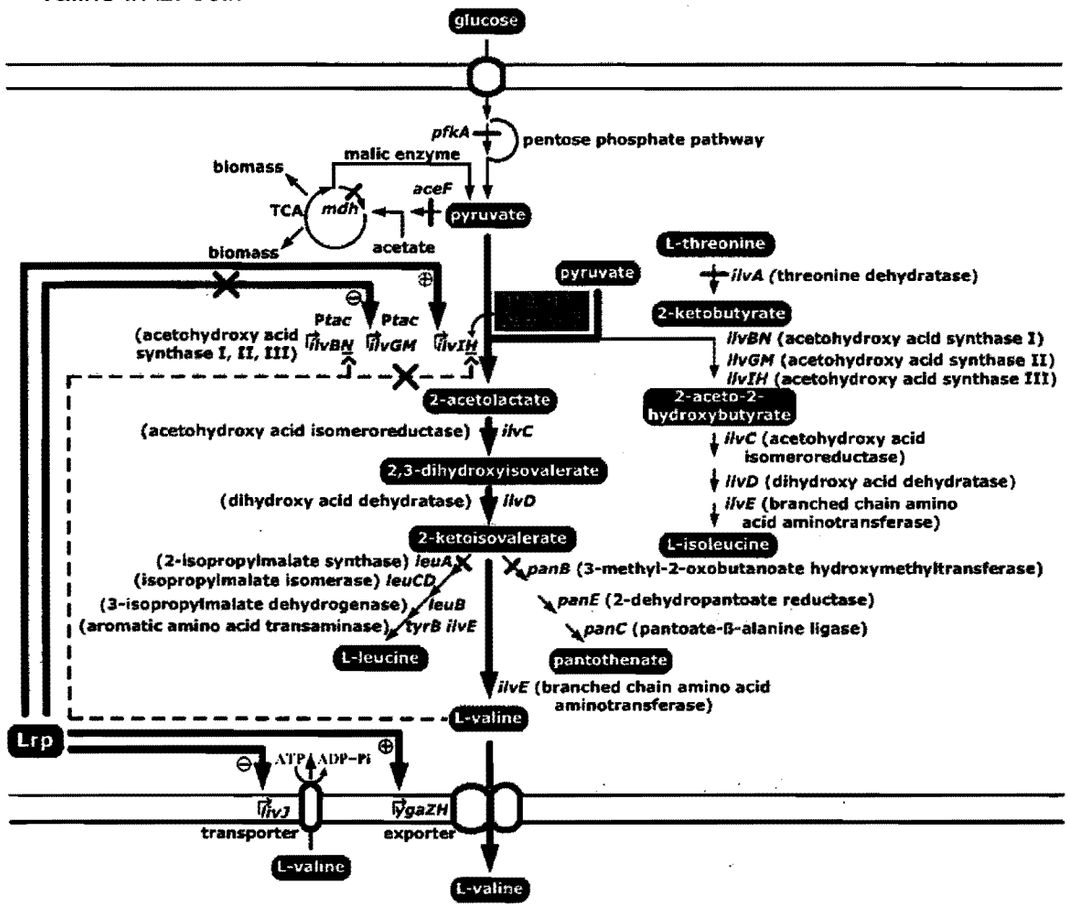
(a) Explain why one would want to perform a human forensic investigation. (5 marks)

(b) Discuss potential benefits of human genome research. (20 marks)

Question 8

(a) Explain what you understand by metabolic engineering, highlighting how understanding of interactomics may aid in metabolic engineering studies. (10 marks)

(b) L-valine, an amino acid, can be produced by genetically engineered *Escherichia coli.* Shown below is a biosynthetic pathway for commercial production of L-valine in *E. coli.*



*(Source: Park J H et al. 2007. PNAS **104**:7797-7802)*

Elucidate the regulations involved and genetic strategies used for constructing the L-valine-producing *E. coli* strain. (15 marks)

END OF QUESTION PAPER