

**W1-2-60-1-6**

## JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

**UNIVERSITY EXAMINATIONS 2017/2018**

**YEAR 4 EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN INDUSTRIAL BIOTECHNOLOGY AND APPLIED BIOENGINEERING**

**HBB 2436: DOWNSTREAM PROCESSING II**

**DATE: JANUARY 2018 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

QUESTION ONE (30 MARKS)

Briefly describe the following;

i) Downstream processing (5 marks)

ii) What is the importance of heterologous protein expression (5 marks)

iii) Inclusion bodies (2 marks)

iv) List three ways for secretion of expressed proteins in bacteria (3 marks)

v) State five important properties of commercial filter membrane materials used in ultrafiltration and nanofiltration (5 marks)

vi) Electroosmosis (5 marks)

vii) Capillary electrochromatography (5 marks)

viii) Affinity membrane chromatography (5 marks)

QUESTION TWO

Outline all necessary experimental procedures, from DNA sequence of insulin leading to over-expression of recombinant insulin and its affinity purification from *E.coli* host (20 marks)

QUESTION THREE

a) Briefly describe two techniques used for monitoring expression of recombinant protein expression (10 marks)

b) By providing one specific example in each case, briefly describe four methods of labeling probes for hybridization (10 marks)

QUESTION FOUR

Discuss product polishing processes during the final purification steps of biotechnology products (20 marks)