



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

BACHELOR OF SCIENCE HONOURS IN APPLIED BIOTECHNOLOGY

ADVANCED BIOCHEMISTRY AND MOLECULAR PHYSIOLOGY (SBB4101)

Main Examination Paper

DECEMBER 2024

This examination paper consists of 2 pages

Time Allowed : 3 hours
Total Marks : 100
Special Requirements : NONE
Examiner's Name : DR E. ZUMBIKA & PROFESSOR A.H. SIWELA

INSTRUCTIONS

1. Answer **Four (4)** questions. Each question carries 25 marks.
2. Where a question contains subdivisions, the mark value for each subdivision is given in brackets.
3. Illustrate your answer where appropriate with large, clearly labelled diagrams.

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
TOTAL FOR FOUR QUESTIONS	100

1. (a) Give an account of the biochemical steps of skeletal muscle contraction. (10 marks)
- (b) With the aid of a schematic diagram, review all the stages of mature red blood cell formation, highlighting three pathological manifestations associated with defective erythropoiesis. (15 marks)
2. (a) Give a brief account of the pathway for insulin secretion. (8 marks)
- (b) Outline key functional anatomic components of the nephron and describe physiological mechanisms of glucose, bicarbonate and phosphate absorption. (17 marks)
3. (a) Briefly describe the diversity, distribution and function of isoforms of mammalian glutathione S-transferases. (10 marks)
- (b) With the aid of a diagram, give a detailed account of protein import into the mitochondrial matrix. (15 marks)
4. (a) Briefly review the canonical beta-catenin signalling pathway, highlighting its biological significance and list three diseases that arise from its dysregulation or mutations. (12 marks)
- (b) Describe the canonical JAK-STAT signalling pathway and in your answer include its physiological importance and regulation. (13 marks)
5. (a) Indicate which statements are True and which ones are False with regards to proteins that are synthesized and secreted as zymogens.
- (i) Pepsin. (1 mark)
 - (ii) Lysozyme. (1 mark)
 - (iii) Collagen. (1 mark)
 - (iv) Enterepeptidase. (1 mark)
 - (v) Thrombicin. (1 mark)
- (b) Describe how decontamination and detoxification of aflatoxins can be achieved. (20 marks)
6. (a) Discuss the transportation of steroid hormones up to mitochondria of the target cells. (15 marks)
- (b) Describe the active site of carbonic anhydrase and the mechanism of action of the enzyme. (10 marks)

END OF EXAMINATION PAPER