MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya
Tel: +254(0) 799 529 958, +254(0) 799 529 959, + 254 (0) 712 524 293,
Website: info@must.ac.ke Email: info@must.ac.ke

University Examinations 2024/2025

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL MICROBIOLOGY

HMM 3213: MICROBIAL PHYSIOLOGY

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
Ensure that all your answers are properly numbered
Part I multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark
Part II: Short Answer Questions – Answer questions following each other on the answer booklet
Part III: Long Answer Questions – Answer each question on the answer booklet

SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)

1. An obligate halophile requires high:
   a) pH
   b) pH
   c) Temperature
   d) Salt
2. In aerobic respiration, the terminal electron acceptor is
   a) Oxygen
   b) Nitrogen
   c) Hydrogen

d) Nitrate

3. The reactions of the cell that are carried out for releasing energy are called
   a) Catabolism
   b) Metabolism
   c) Anabolism
   d) Activation energy
4. In which of the following phases are secondary metabolite produced during bacterial growth?
   a) Lag phase
   b) Log/Exponential phase
   c) Stationary phase
   d) Death phase
5. As electrons flow through the chains, much of their free energy is conserved in the form of ATP. This process is called
   a) Electromotive potential
   b) Dehydrogenations
   c) Oxidative phosphorylation
   d) None of these
6. What are molecular chaperones?
   a) Enzymes
   b) Cell mass
   c) Tumor
   d) Helper proteins
7. What does the term 'nitrogen fixation' mean?
   a) Conversion of nitrogen compounds into gaseous nitrogen
   b) Conversion of ammonia into nitrates by the bacteria present in soil
   c) Release of nitrogen present in dead organic matter back into soil
   d) Conversion of atmospheric nitrogen to a more usable form for living organisms
8. How many molecules of ATP are required to fix one molecule of nitrogen?
   a) 12

b) 20

d) 16

9. Electron transport system (ETS) is present in which of the following parts of mitochondria?
   a) Inner membrane
   b) Outer membrane
   c) Matrix
   d) Stroma
10. Which of the following products of glucose oxidation are necessary for oxidative phosphorylation?
   a) Pyruvate
   b) NADH and FADH2
   c) Acetyl COA
   d) NADPH and ATP
11. Which enzyme is primarily responsible for breaking down hydrogen peroxide in cells?
   a) Catalase
   b) Superoxide dismutase
   c) Glutathione peroxidase
   d) Lactate dehydrogenase
12. What role does glutathione play in oxidative stress?
   a) It generates free radicals
   b) It acts as an antioxidant
   c) It promotes inflammation
   d) It inhibits apoptosis
13. What is the primary function of glycolysis?
   a) To produce glucose
   b) To generate ATP and pyruvate
   c) To synthesize fatty acids
   d) To oxidize NADH

14. How many ATP molecules are produced in the glycolytic pathway per glucose molecule?
    a) 2 ATP
    b) 4 ATP
    c) 6 ATP
    d) 36 ATP
15. What is the initial substrate that enters the TCA cycle?
    a) Acetyl-CoA
    b) Pyruvate
    c) Citrate
    d) Alpha-ketoglutarate
16. What is the main function of the TCA cycle?
    a) ATP synthesis through oxidative phosphorylation
    b) Generation of NADH and FADH2 for the electron transport chain
    c) Conversion of glucose to pyruvate
    d) Synthesis of fatty acids
17. What are chemolithotrophs?
    a) Organisms that obtain energy from sunlight
    b) Organisms that obtain energy from organic compounds
    c) Organisms that obtain energy from inorganic compounds
    d) Organisms that cannot produce energy
18. What distinguishes chemolithotrophs from other autotrophs?
    a) Their reliance on sunlight for energy
    b) Their use of inorganic compounds as energy sources
    c) Their ability to perform fermentation
    d) Their production of methane
19. What is the primary function of the bacterial cell wall in osmotic control?
    a) Energy production
    b) Protection against phagocytosis
    c) Maintaining cell shape and preventing lysis

d) Nutrient absorption

20. Which of the following is an example of an osmoprotectant used by bacteria?

a) Glucose

b) Trehalose

c) Lactic acid

d) Acetic acid

SECTION B: SHORT ANSWER ALL QUESTIONS (40 MARKS)

1. Explain with the help of a diagram the diauxic growth curve of microoganisms (4 marks)
2. Outline the effects of hypoosmotic stress in bacteria (4 marks)
3. Explain the role played by molecular chaperons when bacteria is subjected to heat shock (4 marks)
4. Describe the structure and function of factor V (ATPase in the electron transport chain (4 marks)
5. Differentiate between the following terms:
   i) Anabolism (2 marks)
   ii) Catabolism (2 marks)
6. Outline any symbiotic nitrogen fixing bacteria (4 marks)
7. Explain the role played by the following molecules in nitrogen fixation.
   i) Leghaemoglobin (2 marks)
   ii) *Nif* genes (2 marks)
8. Write down the equations catalyzed by the following enzymes in defense against Reactive Oxygen Species by microoganisms.
   i) Superoxide dismutase (2 marks)
   ii) Hydrogen peroxide (2 marks)
9. Classify microorganisms according to their ability to grow in different pH conditions (4 marks)
10. Outline the various uses of propionic acid (4 marks)

SECTION C: LONG ANSWER TWO QUESTIONS (40 MARKS)

1.Discuss the electron transport chain and all its components (26 marks)

2.i) Discuss in detail the physical requirements of microbial growth (8 marks)

ii) Explain with the help of diagrams where applicable the action taken by molecular chaperons when stress is introduced into a cell (12 marks)

3. Discuss in detail the nodulation process in leguminous plants (20 marks)