



AFRICA
UNIVERSITY
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“Investing in Africa’s Future”

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES
DEPARTMENT OF HEALTH SCIENCES

NSLS204: MICROBIOLOGY I: BACTERIOLOGY
END OF SEMESTER EXAMINATIONS

NOVEMBER 2025
LECTURER: Mr Z CHIWODZA

DURATION: 3 HOURS

INSTRUCTIONS

1. Write your candidate number on the space provided on top of each page
 2. Answer **all** questions in sections A on the question paper.
 3. Answer **all** questions in section B on separate answer sheets provided.
 4. Answer any **3** questions in section C on separate answer sheets provided
 5. The mark allocation for each question is indicated at the end of the question
 6. Credit will be given for logical, systematic and neat presentations in sections B and C
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SECTION A : MULTIPLE CHOICE [40 MARKS]

- Answer all questions by encircling the correct response T for TRUE or F for FALSE for each statement in all the questions
- Each correct response is allocated HALF A MARK

1. In genomic typing:

- T F PCR can detect drug resistant genes
- T F PFGE is used for outbreak typing
- T F Whole-genome sequencing can track transmission chains
- T F qPCR can detect molecular barcodes in realtime.

2. Regarding *Corynebacterium diphtheriae*:

- T F Produces an exotoxin that inhibits protein synthesis
- T F Can cause pseudomembrane formation in the throat
- T F Is prevented by DPT vaccination
- T F Is Gram-negative rod

3. Biosecurity in the microbiology lab requires:

- T F Restricted access to pathogen storage areas
- T F Secure record-keeping of select agents
- T F Use of BSL-3 facilities for *M. tuberculosis*
- T F Allowing food and drink inside the lab for convenience

4. In antimicrobial stewardship:

- T F The lab provides AST data to guide therapy
- T F Empirical therapy should always be continued without adjustment
- T F De-escalation is part of stewardship principles
- T F Avoiding unnecessary broad-spectrum antibiotic use is essential

5. *Haemophilus influenzae*:

- T F Requires X (hemin) and V (NAD) factors for growth
- T F Can cause meningitis in children
- T F Is prevented by Hib vaccination
- T F Is Gram-positive coccus

6. A 45-year-old HIV-positive man presents with fever, night sweats, and weight loss. A sputum sample is collected.

- T F *Mycobacterium tuberculosis* is the likely causative organism.
- T F A modified Zeil Neilson stain can be done to test the sample
- T F Culture on Lowenstein–Jensen takes 3 days to identify the organism
- T F GeneXpert on the sputum sample can detect rifampicin resistance

7. Regarding *Clostridium tetani*:

- a) T F Causes acute flaccid paralysis
- b) T F Produces tetanospasmin
- c) T F Is prevented by DTP vaccination given at birth
- d) T F Is a Gram-positive spore-forming anaerobe

8. A neonate in the Neonatal Intensive Care Unit develops sepsis. Common causes include:

- a) T F *Streptococcus agalactiae*
- b) T F *Listeria monocytogenes*
- c) T F *Escherichia coli*
- d) T F *Staphylococcus epidermidis*

9. Endotoxins are associated with:

- a) T F Lipid A portion of LPS
- b) T F Gram-negative bacteria
- c) T F Induction of fever and shock
- d) T F Neutralization by specific antitoxins

10. Quality assurance in bacteriology:

- a) T F Includes daily use of control strains in AST
- b) T F Requires participation in external quality assessment schemes
- c) T F Involves strict adherence to SOPs
- d) T F Ignores calibration of equipment to save costs

11. Antimicrobial classes:

- a) T F Glycopeptides inhibit cell wall synthesis
- b) T F Tetracyclines inhibit protein synthesis at the 30S subunit
- c) T F Macrolides inhibit DNA replication
- d) T F Rifampicin inhibits RNA polymerase

12. Sterilization methods include:

- a) T F Autoclaving at 121°C for 15 minutes
- b) T F Dry heat sterilization at 160°C for 2 hours
- c) T F Filtration for heat-labile solutions
- d) T F 70% ethanol ensures sporicidal sterilization

13. In specimen handling:

- a) T F CSF should be transported at room temperature and processed urgently
- b) T F Blood cultures must be collected before antibiotic administration
- c) T F Stool samples for culture should be placed in Cary–Blair transport medium
- d) T F Urine samples for culture should be collected from catheter bags

14. A 30-year-old woman presents with food poisoning after eating improperly stored rice.

- a) T F The most likely cause is *Bacillus cereus*
- b) T F It produces a heat-stable enterotoxin
- c) T F It is a Gram-negative rod
- d) T F It can cause an emetic or diarrheal syndrome

15. A 20-year-old student develops a sore throat, fever, and cervical lymphadenopathy.

- a) T F *Streptococcus pyogenes* is a possible cause

- b) T F It is Group A beta-hemolytic streptococcus
- c) T F It can lead to rheumatic fever
- d) T F It is catalase positive

16. A patient with a catheter develops fever and cloudy urine. Culture grows *Klebsiella pneumoniae*:

- a) T F It produces a capsule as a virulence factor
- b) T F It is urease positive
- c) T F It is a Gram-negative rod
- d) T F It is non-motile

17. Regarding MRSA.

- a) T F MRSA is resistant to methicillin due to altered PBPs
- b) T F Vancomycin is commonly used for treatment
- c) T F MRSA is a Gram-negative rod
- d) T F Infection control requires contact precautions

18. Infection prevention in a hospital setting includes:

- a) T F Hand hygiene before and after patient contact
- b) T F Reuse of disposable syringes after disinfection
- c) T F Contact isolation for MRSA-positive patients
- d) T F Proper disposal of sharps in puncture-proof containers

19. *Neisseria gonorrhoeae*:

- a) T F Is oxidase positive
- b) T F Ferments maltose and glucose
- c) T F Can cause pelvic inflammatory disease
- d) T F Is usually resistant to penicillin

20. Antimicrobial resistance in Gram-negative bacteria may involve:

- a) T F Production of extended-spectrum beta-lactamases (ESBLs)
- b) T F Altered penicillin-binding proteins (PBPs)
- c) T F Efflux pumps
- d) T F Capsule production

SECTION B [20 MARKS]

Answer all questions on separate answer sheets provided

1. List four (4) major differences between Gram-positive and Gram-negative cell walls. **[4 marks]**
2. State four (4) laboratory precautions necessary when working with Sputum samples. **[4 marks]**
3. Give one bacterial example (Genus and species) for each:
 - a. Enterobacteriaceae,
 - b. Spirochete,
 - c. Atypical bacterium,
 - d. Alpha haemolytic coccus. **[4 marks]**
4. List four common errors that may occur during antimicrobial susceptibility testing. **[4 marks]**
5. Mention four toxins or virulence factors associated with following bacteria
 - a. *Clostridium difficile*
 - b. *Staphylococcus epidermidis*
 - c. Enterotoxigenic *Escherichia Coli*
 - d. *Haemophilus ducreyi* **[4 marks]**

SECTION C [75 marks]

Answer any 3 questions from this section on separate answer sheets provided

- 1) Discuss the mechanisms of bacterial resistance and how these mechanisms are detected in the laboratory. **[25 marks]**
- 2) **Thando** visited Mozambique for 2 weeks. Upon return, she presents with persistent rice watery diarrhoea. Discuss the pathogenesis of the most likely bacterial cause and outline the laboratory diagnostic process from sample collection to reporting. **[25 marks]**
- 3) Discuss the role of molecular diagnostics in medical bacteriology. **[25 marks]**
- 4) You are working in a hospital laboratory that has isolated a suspected carbapenem-resistant *Klebsiella pneumoniae* strain. Discuss phenotypic identification of *Klebsiella* and how resistance can be confirmed in the lab. In your discussion include the role of the laboratory in guiding infection control measures. **[25 marks]**
- 5) Compare and contrast the pathogenesis and clinical features of *Staphylococcus aureus* and *Streptococcus pyogenes* infections, highlighting laboratory approaches to differentiate them. **[25 marks]**