NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES SBB 1207
BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS
DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY
THEORY: GENERAL MICROBIOLOGY I SBB 1207
JULY2001 SUPPLEMENTARY EXAMINATION
2 Hours (100 marks)
INSTRUCTIONS
Answer Question No. 1 and any other 3 Questions. Where a question contains subdivisions, the mark value for each subdivision is given in brackets. Illustrate your answer where appropriate with large, clearly labelled diagrams.

1.(i) Describe briefly the contribution/s of John Tyndal to Microbiology. (3 marks)

(ii) Draw and label a diagram of a generalized bacterial cell. (5 marks)

(iii) Use differences between prokaryotic and eucaryotic cells in ribosomal and cell wall structures, to explain the relative sensitivities of the two cell types, to penicillin, cycloheximide and tetracycline. (8 marks)

(iv) What field of microbiology deals with classification? Who devised the kingdom Protista? Use typical examples of microogranisms to show why the kingdom was devised. Which of the kingdoms of living organisms, contain micro-organisms? (4 marks)

(v) List 3 general properties of plasmids? Use examples to explain the role of some plasmids in
(a) bacterial conjugation
(b) antibiotic resistance (4 marks)

(vi) List two morphological features of phycomycetous fungi and name with suitable examples, the other main groups of fungi.
Draw an aspergillus, a penicillium, a zygospore, an ascus. Name one budding yeast and one fission yeast. (6 marks)

(vii) What disease led to the discovery of viruses?
What early observation showed that the disease was not caused by bacteria?
Describe briefly the general structure of a virus and use a diagram to show the structure of a T-even bacteriophage. (5 marks)

(viii) Use examples to classify the protozoa on the basis of their locomotory organelles. Name two pathogenic protozoa important in Zimbabwe and the diseases they cause. (5 marks)

odd no's

2.(i) Define the terms culture medium, tissue culture, pure culture. (2 marks)

(ii) List the properties of agar which make it an ideal solidifying agent for microbiological culture media and its concentration (range) normally used. (4 marks)

(iii) Give two examples of general purpose media for each of bacteria and the fungi. (2 marks)

(iv) List three classes of compounds which can be used to make media selective. (1 1/2 marks)

(v) The composition of MacConkey and Bismuth sulphite agars (A and B, respectively) are as follows:

A		B	
Peptone	17g/l	Beef extract	5g/litre
Proteose peptone	3g	Peptone	10g
Lactose	10g	Glucose	5g
Bile Salts	1.5g	Na_2HPO_4	4g
NaCl	5.0g	$FeSO_4$	0.3g
Neutral red	0.03	Bismuth sulphite	8g
Crystal violet	0.001	Brilliant green	0.025g
Agar	18.00	Agar	20g

Explain how specific components of each medium make it selective and/or differential. (6 marks)

(vi) Describe the principle and practice of using heat as an enrichment technique for isolating <u>Bacillus</u> spp. from a sample. (4 1/2 marks)

3.(i) List the stains and reagents used sequentially in
(a) the Gram Stain,
(b) the acid fast stain (AFS) (4 marks)

(ii) Explain the clinical importance of the AFS and state the final colour of the target organism. How does the Ziehl-Neelsen method make the technique possible? (3 marks)

(iii) What major difference between Gram positive and Gram negative bacteria is reflected in the Gram reaction of the two groups. Explain how this difference may breakdown in relatively old cultures. (2 marks)

(iv) What would be the appearance of the cells of Gram variable organism after the Gram stain. (2 marks)

(v) Describe how you would carry out a spore stain for a speciment smeared on a slide. (2 marks)

even no's

(vi) What is "Resolution" in microscopy? What factors affect Resolution and how is it improved in the light, the ultraviolet and the electron microscopes? (4 marks)

(vii) What device/s will enable dimensions of microbial cells to be determined microscopically? (1 mark)

(viii) List two facilities needed for immunofluorescent microscopic observations and give one important use of that kind of microscopy. (2 marks)

4.(i) Draw a diagram to illustrate the main stages of a bacterial growth curve. (1 1/2 marks)

(ii) What is the difference between a viable and a total cell count? (1 mark)

(iii) State or name

a) one precaution necessary while carrying out a pour plate. (1 mark)

b) two clinical applications of a total cell count (3 marks)

c) The equipment used for the total cell count and the important dimensions that must be known. (3 marks)

(iv) If 180, 200 and 190 colonies are obtained on triplicate agar plates inoculated with 0.2 ml volumes of 10^{-4} dilution of a culture, calculate the viable count of the culture. (5 marks)

(v) State the equipments and conditions for sterilising the following: MacConkey agar medium, petri dishes, pipettes and inoculation loops. (3 marks)

(vi) Name (a) two microbiologists and antibiotics discovered by them. (2 marks)

(b) one chemo-therapeutic agent that is not an antibiotic (1/2 marks)

odd no's

5. (i) What bacterial taxa bear these suffices:- -ceae, ales? (1 mark)

(ii) Name the individual associated with numerical taxonomy and outline three principles used. (3 marks)

(iii) In a numerical taxonomic study, the following results were obtained for two organisms X and Y:

Tests	X	Y
1	+	+
2	+	-
3	-	+
4	-	-
5	+	+
6	+	-

Calculate (a) the similarity coefficient (2 marks)
(b) the matching coefficient (2 marks)

(iv) Discuss the principle method of using the "melting" temperature (Tm) of an isolate DNA sample for estimating its G + C Content. (4 marks)

(v) Describe with equations, where possible, the scientific basis of catalase, urease, indole, oxidase and coagulase tests used in bacterial identification. For each test state one organism or one group of organisms in which a positive or negative result can be very important in differentiating it from related organism/s or group of organisms. (8 marks)

6.(i) What are the main characteristics of bacteria of the genus Bacillus? (3 marks)

(ii) What are coliforms? Name the classical species and state why they are used, traditionally, as indicators of food and water sanitary quality. (7 marks)

(iii) In a survey, Pseudomonas and Bacillus were found in foods served to the elderly in a nursing home. State the Gram reactions of the two organisms and state (with reasons) the organism that would be of much concern to health authorities. (3 marks)

(iv) Explain why an enrichment technique is often used for isolating Salmonella from a food or clinical sample. Use a sketch to illustrate the procedure. (5 marks)

(v) Name one tubed medium which can be used for confirming identity of a Salmonella isolate and describe the organism's typical reactions in the medium. (2 marks)

odd no's

END OF QUESTION PAPER