NATIONAL BOARD FOR TECHNICAL EDUCATION
KADUNA

HIGHER NATIONAL DIPLOMA

IN

MICROBIOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

2002

PLOT 'B' BIDA ROAD, P.M.B. 2239, KADUNA-NIGERIA

AIMS AND OBJECTIVES

This programme is designed to produce Technologists capable of carrying out microbiological analysis and applying the knowledge in the control and use of microbes.

LEVEL OF PROGRAMME

Higher National Diploma (HND)

ENTRY REQUIREMENT

The entry requirement into the HND Science Laboratory Technology (Microbiology) is at least a lower credit level pass in National Diploma (ND) in Science Laboratory Technology and a minimum of twelve (12) months of supervised industrial experience.

In exceptional cases, ND diplomates with a pass (CGPA of 2.00 - 2.49) grade but has two or more years of cognate working experience in the specific field may be considered for admission into the HND Programme.

FIRST YEAR FIRST SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
GLT 301	Laboratory Management	2	0	0	2	2	
GLT 302	General Instrumentation	1	0	2	2	3	
GLT 303	Biological and Chemical Instrumentation	2	0	3	3	5	
COM 123	Computer Application Package	1	0	2	2	3	
STH 301	Microbial Biochemistry	2	0	0	2	2	STC 222
STM 311	Bacteriology	2	0	3	3	5	STB 211
STM 312	Microbiological Techniques I	1	0	3	2	4	
BAM 216	Practice of Entrepreneurship	2	0	0	2	2	
GNS 301	Use of English	2	0	0	2	2	
	TOTAL					28	

GLT: General Laboratory Technique
COM: Computer Science
STH: Biochemistry
GNS: General Studies
BAM: Business Administration and Management

FIRST YEAR SECOND SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
STM 321	Mycology	1	0	3	2	4	STB 211
STM 322	Microbiological Techniques II	1	0	3	2	4	
STM 323	Environment Microbiology	2	0	3	3	5	STB 211
STM 324	Food Microbiology	1	0	2	2	3	STB 211
STM 325	Microbial Physiology and Metabolism	2	0	2	3	4	STB 211
STM 326	Virology	2	0	2	3	4	STB 211
STB316	Parasitology	2	0	3	3	5	
GNS 302	Appreciation and Oral Composition Literary	2	0	0	2	2	
	TOTAL					31	

SECOND YEAR FIRST SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
STM 411	Microbial Genetics	2	0	0	2	2	STM 311 STM 326
STM 412	Microbiological Techniques III	1	0	3	2	4	STM 322
STM 413	Pharmaceutical Microbiology	2	0	2	3	4	STH 301 STM 325
STM 414	Pathogenic Microbiology	2	0	3	3	5	STM 311 STM321
STM 415	Immunology and Public Health	1	0	3	2	4	STM 326
STB 421	Applied Genetics (Plant Breeding)	2	0	2	3	4	
GNS 413	Industrial Management	3	0	0	3	3	
	TOTAL					26	

SECOND YEAR SECOND SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
STM 421	Microbiological Quality Control	2	0	4	4	6	STM 312 STM 322
STM 422	Industrial Microbiology	2	0	4	4	6	STM 324 STH 301
STM 423	Waste Treatment and Utilization	2	0	2	3	4	STM 325 STM 323
STM 424	Seminar	0	2	0	2	2	
STB 422	Applied Genetics (Animal Breeding)	1	0	2	2	3	
STM 425	Project	0	0	12	6	0	
	TOTAL					21	

PROGRAMME: **SCIENCE LABAORATORY TECHNOLOGY (MICROBIOLOGY OPTION)**

COURSE: MICROBIAL BIOCHEMISTRY

CODE: **STH 301**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 0

UNIT: **2.0**

GOAL: This course is designed to enable students program, using a low-level language.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the structure, properties and functions of nucleic aid and biosynthesis of proteins.
2.0 Understand the structure and function of biological membranes.
3.0 Understand the pathways of carbohydrates, protein and lipid metabolism.
4.0 Understand the correlation in the pathways of carbohydrates, protein and lipid metabolism.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIAL BIOCHEMISTRY		**Course Code: STH 301**	**Contact Hours: 2 – 0 - 0**
Week	**General Objectives: 1.0 Understand the structure, properties and functions of nucleic acid and biosynthesis of proteins**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 3	NUCLEIC ACID AND PROTEIN 1.1 Explain the chemical structure and functions of nucleic acids (purine, pyrimidine, nucleosides and nucleotides). 1.2 Describe the biosynthesis of DNA and RNA. 1.3 Explain the Watson-Crick model of the DNA and its replication. 1.4 Explain the main steps involved in replication of DNA and transcription of RNA. 1.5 Explain the chemical structure and function of amino acids and proteins. 1.6 Explain amino acid sequences of protein by: (i) specification by genes. (ii) relationship between amino acid sequence and protein conformation.	Explain with models of the DNA and RNA	Models of DNA and RNA

Week	General Objectives: 2.0 Understand the structure and function of biological membranes		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 – 5	BIOLOGICAL MEMBRANE 2.1 Describe the chemical structure of biological membrane. 2.2 Explain the general functions of biological membranes. 2.3 Draw and explain the lipid layer of membrane and state their biological implications (phospholipids and glycolipids). 2.4 Explain the role of proteins in membrane structures. 2.5 Describe the fluid mosaic model of the biological membrane. 2.6 Describe the methods of membrane isolation.	Explain with a model of biological membrane	Model of biological membrane

Week	General Objectives: 3.0 Understand the pathways of carbohydrates, protein and lipid metabolism		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 – 9	METABOLIC PATHWAYS 3.1 Define glycolysis. 3.2 Explain the glycolytic pathway and the conversion of pynivate acetyl CoA. 3.3 Explain the term substrate level phosphonylation. 3.4 Distinguish between aerobic and anaerobic glycolysis. 3.5 List the main enzymes of glycolysis. 3.6 Indicate the steps that consume or yield energy in glycolytic pathway. 3.7 Deduce the net energy yield in glycolytic pathway. 3.8 Describe the alternative pathways of glucose oxidation. 3.9 State the importance of 3-8 above. 3.10 Describe oxidation of fatty acids. 3.11 Explain the sequence of reactions in oxidation of fatty acids. 3.12 Describe (a) the β-oxidation of fatty acids to acetyl – CoA. (b) β-oxidation of unsaturated fatty acids and odd number fatty acids.	Illustrate properties of d- block using the periodic table. Lecture “ “ “ “ “ “	Periodic table - do – “ “ “ “ “

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**
	3.13 Calculate energy yield in the degradation of fatty acids. 3.14 Explain how acetyl – CoA acts as precursor in the biosynthesis of fatty acids. 3.15 Describe the two pathways of fatty acid biosynthesis i.e. cytoplasmic and mitochondrial. 3.16 Explain the processes of the degradation of proteins. 3.17 Explain the terms transamination, oxidative deamination and decarboxylation. 3.18 Explain how amino acids can be a source of cellular energy. 3.19 Explain how the C-skeleton of amino acids are either converted into fatty acids and glucose, or oxidized via the TCA cycle. 3.20 Explain the terms ketogenic and glucogenic amino acids with examples.		

Week	General Objectives: 4.0 Understand the correlation in the pathways of carbohydrates, protein and lipid metabolism.		
	Special Learning Objective	**Teachers Activities**	**Resources**
10 - 14	PATHWAYS OF CARBOHYDRATE, PROTEIN AND LIPID METABOLISM 4.1 Explain Anaplerosis (anaplerotic sequence). 4.2 State the biological importance of the TCA cycle. 4.3 Explain the sequence of reactions in TCA cycle. 4.4 List the enzymes involved in each step. 4.5 Explain oxidation in the TCA cycle as dehydrogenation reactions involving NAD and FAD. 4.6 Explain with the aid of a schematic diagram that NAD and FAD are themselves oxidized through an electron transport system/respiratory chain. 4.7 Explain that the processes in 4.5 and 4.6 are coupled with phosphonylation of ADP to produce ATP (oxidative phosphonylation). 4.8 Explain that for each molecule NADH+ H^+ oxidized 3 ATP molecules are formed and for each molecule of $FADH_2$ oxidized 2 molecules of ATP are formed. 4.9 Determine the number of ATP produced per molecule of pyruvate through the TCA cycle.	Lecture Assignments	Blackboard Charts

Week	**General Objectives:**		
	Special Learning Objective	**Teachers Activities**	**Resources**
	4.10 Determine the number of ATP molecules produced by the complete degradation of a molecule of glucose. 4.11 Determine the number of ATP molecules produced in eucaryote and prokaryotes from the complete degradation of 1 molecule of glucose. 4.12 Explain glyoxylate cycle. 4.13 Explain the sequence of reactions in the glyoxylate cycle. 4.14 Explain the biological importance of the glyoxylate cycle.	Lecture Assignments	TCA cycle

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **BACTEROLOGY**

CODE: **STM 311**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 3

UNIT: **3.0**

GOAL: This course is designed to provide the student with a good knowledge of bacteria, its structure, taxonomy, nature and economic importance.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand bacterial structure.
2.0 Know the principles of bacterial nomenclature and taxonomy.
3.0 Know the methods of identification of bacteria.
4.0 Understand the principles and methods of cultivation and maintenance of bacterial cultures.
5.0 Know major bacterial taxonomic groups.
6.0 Know the principles and methods of controlling bacteria number in the environment.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: BACTERIOLOGY		**Course Code: STM 311**	**Contact Hours: 2 – 0 - 3**
Week	**General Objectives: 1.0 Understand bacterial structure**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 2	ANATOMY AND MORPHOLOGY OF BACTERIA 1.1 Describe with examples the principal gross forms of eubacteria as revealed by light microscopy e.g. cocci, bacilli, cocco-bacilli etc. 1.2 Describe the chemical composition of the bacterial cell wall. 1.3 Describe bacterial cytoplasmic ultrastructures. 1.4 Explain the form and structures of bacterial flagella, pilli and capsules. 1.5 Explain protoplast, sphaeroplasts, L-forms and mycoplasma. 1.6 Prepare slides and observe and draw various bacteria forms under the microscope.	Lecture Give assignment Question and answer technique - do – - do – - do – - do – Supervise students prepare stain view and draw.	Microscopes Slides Incubators Slides of bacteria culture

Week	General Objectives: 2.0 Know the principles of bacterial nomenclature and taxonomy		
	Special Learning Objective	**Teachers Activities**	**Resources**
3 - 4	CLASSFICATION OF BACTERIA 2.1 Explain bacterial class, order, family, genius, species and strain. 2.2 Explain the anatomical and physiological properties used as criteria in the development of the determinative key in bacteriology. 2.3 Draw a chart of bacterial taxonomy based on 2.2 above. 2.4 Explain bacterial taxonomy based on D.N.A. homology 2.5 Explain numerical taxonomy. 2.6 Explain biochemical taxonomy.	Lectures Assignments Questions and answer techniques - do – - do – - do – - do – - do –	Blackboard Projectors Taxonomic charts

Week	General Objectives: 3.0 Know the methods of identification of bacteria		
	Special Learning Objective	**Teachers Activities**	**Resources**
5 - 6	IDENTIFICATION OF BACTERIA 3.1 Explain the following staining terminologies: mordant, accentuators, vital staining. 3.2 Differentiate between acid, basic and neutral staining. 3.3 Explain the formulation of stains important in the identification of bacteria. 3.4 Explain the principles of the reactions of the stains in 3.3 above. 3.5 List and explain the principles of various biochemical methods used in bacterial identification. 3.6 Identify the reagent formulations in 3.5 above. 3.7 Carry out the biochemical tests in 3.5 above e.g. sugar fermentation reactions, methyl red, MRUP etc.	Lectures Practical Assignment Questions and answer techniques Grade log books (practical notebooks) Students to prepare different reagents used for 3.1 Supervise students to carry out biochemical identification of different Gram positive and Gram-negative bacteria e.g. sugar fermentation methyl red, MRUP etc.	Microscope Glass ware Slides Incubators Weighing balances Water baths Hot plates Magnetic stirrers

Week	General Objectives: 4.0 Understand the principles and methods of cultivation an maintenance of bacterial cultures		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 9	BACTERIA CULTURES AND GROWTH CHARACTERISTICS 4.1 Explain factors which influence bacterial growth under laboratory conditions e.g. pH, temperature, moisture, nutrient requirements etc. 4.2 Draw and explain the bacterial growth curve. 4.3 Explain types of culture media, e.g. enriched media, differential media etc. 4.4 Identify examples of various bacteriological media in 4.3 above. 4.5 Explain the preparation and storage of various bacteriological media. 4.6 Inoculate bacteria on media in plate, tube and bottle. 4.7 Prepare various media for isolation and identification of specific bacteria e.g. mannitol salt agar for **staphylococcus<u>aureus</u>** etc. 4.8 Isolate and identify the organism in 4.6 above. 4.9 Describe various methods of anaerobic jar. 4.10 Cultivate anaerobic bacteria using anaerobic jar.	Lectures Give assignment Question and answer techniques Laboratory demonstration activities Carry out the inoculation of different bacterial media in tube plates and bottle. Prepare different microbiological media for different uses. Isolate common bacteria. Carry tests to identify common bacteria. Carry out cultivation of anaerobic bacteria.	Glass ware Autoclave Hot air oven Water bath pH meter Thermometers Refrigerator Inoculating loops Anaerobic jar U-V lamps

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**
	4.11 Describe medium preparation and the cultivation of micro aerophilic bacteria e.g **Neissaria spp.** 4.12 Prepare media for special purposes e.g. transport media, media for growth of spirochaetes, leptospira and mycoplasma. 4.13 Describe the various methods for the separation of mixed cultures. 4.14 Explain the quality control methods of various prepared media. 4.15 Describe methods of maintenance and storage of stock cultures. 4.16 Prepare and store stock culture.	Prepare media for special purposes. Carry out isolation of **Neisseria spp.** Prepare and store stock culture	

Week	General Objectives: 5.0 Know major bacterial taxonomic groups		
	Special Learning Objective	**Teachers Activities**	**Resources**
10-12	TAXONOMIC GROUPS OF BACTERIA 5.1 Identify the bacterial taxonomic orders. 5.2 List families and Genera of the orders. 5.3 Explain the morphological, cultural, biochemical and antigenic properties as well as economic importance of the following groups of bacteria: a) Gram negative aerobic rods and colic-pseudomonadaceae, acetobacteriaceae, rhizobiaceae, brucellaceae. b) Gram negative; facultatively anaerobic rods, enterobacteriaceae, vibrionaceae. c) Gram negative, anaerobic rods- bacteriodaceae. d) Gram negative heterotrophic aerobic cocci and coccibacilli, Neisseriaceae. e) Gram negative, heterotrophic anaerobic cocci-Veillonellacea. f) Gram negative, chemolithotrophic rods and cocci-Nitrobacteriacea, siderocapsaseae. g) Achabacteria e.g. Gram negative methane – producing rods and cocci. h) Gram positive aerobic/facultatively anaerobic cocci streptococcaceae. i) Gram positive anaerobic cocci – peptococcacceae. j) Gram positive endospore forming rods – bacillaceae. k) Gram positive asporogenous rods – lactobacillaceae. l) Actinomyces and related organisms – streptomycetaceae, planaceae, actinomycetaceae, mycobacteriaceae, propioni-bacteriaceae.	Lectures Assignments Questions and answer technique - do – - do – - do – - do – - do – - do – - do – - do – - do – - do –	Taxonomic charts, tables.

	m) Spirochaetes. n) Genera of uncertain affiliation (differentiate as far as possible) 5.4 Identify examples of the organisms in 5.3 above.	 Practical identification.	Autoclave Incubators Microscopes Glass ware Anaerobic jar

Week	**General Objectives: 6.0 Know the principles and methods of controlling bacterial number in the environment.**		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	6.1 Explain sterilization and disinfection by physical methods. 6.2 Explain sterilization and disinfections by chemical methods. 6.3 Sterilize and disinfect various objects by physical and chemical methods. 6.4 Explain quality control practices involved in 6.1 – 6.3 above.	Lectures Questions and answer technique Laboratory Practical sterilization and disinfection Carry out sterilization of different materials by chemical and physical methods.	Autoclave Refrigerators Bunsen burner Hot air Glass ware Inoculating loops Knives, scalpels UV lamps
	Practical Content		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**

1-2 5-6 7-9	1. Prepare slides and observe and draw various bacteria forms under the microscope. 2. Carry out the biochemical tests in 3.5 above e.g. sugar fermentation reactions, methy1 red, MRUP etc. 3. Inoculate bacteria on media in plate, tube and bottle. 4. Prepare various media for isolation and identification of specific bacteria e.g. mannitol salt agar for **staphylococcus<u>aureus</u>** etc. 5. Isolate and identify the organism in 4.6 above. 6. Cultivate anaerobic bacteria using anaerobic jar. 7 Prepare media for special purposes e.g. transport media, media for growth of spirochaetes, leptospira and mycoplasma. 8. Prepare and store stock culture 9Sterilize and disinfect various objects by physical and chemical methods. 10. Sterilize and disinfect various objects by physical and chemical methods	- Supervise students prepare stain view and draw. - Supervise students to carry out biochemical identification of different Gram positive and Gram-negative bacteria e.g. sugar fermentation methyl red, MRUP etc. Carry out the inoculation of different bacterial media in tube plates and bottle. Prepare different microbiological media for different uses. Isolate common bacteria. Carry tests to identify common bacteria. Carry out cultivation of anaerobic bacteria. Prepare media for special purposes. Carry out isolation of **Neisseria spp.**	- Slides of bacteria culture. - Microscope Glass ware Slides Incubators Weighing balances Water baths Hot plates Magnetic stirrers - Glass ware Autoclave Hot air oven Water bath pH meter Thermometers Refrigerator Inoculating loops Anaerobic jar U-V lamps
13-14		Prepare and store stock culture Practical sterilization and disinfection Carry out sterilization of different materials by chemical and physical methods.	- Autoclave Refrigerators Bunsen burner Hot air Glass ware Inoculating loops Knives, scalpels UV lamps

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: MICROBIOLOGICAL TECHNIQUES I

CODE: **STM 312**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 3

UNIT: **3.0**

GOAL: This course is designed to enable the student apply various scientific techniques in the study of. microorganisms

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand various staining techniques and the preparation of different stains.
2.0 Understand different sterilisation techniques and their applications.
3.0 Understand the preparation and uses of different buffers, ell suspension and dilution fluids.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY		
Course: MICROBIOLOGICAL TECHNIQUES I	**Course Code: STM 312**	**Contact Hours: 1 – 0 - 3**

Week	General Objectives: 1.0 Understand various staining techniques and the preparation of various stains		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 4	STAINING TECHNIQUES 1.1 Describe the procedures for making films or smear preparations from microorganisms and tissue sections. 1.2 Describe the procedures for staining of films and tissue sections. 1.3 Prepare and stain films and smear of microorganisms and tissue sections. 1.4 Describe the preparation of stains and the procedures for the different modifications of Gram's staining techniques. 1.5 Prepare stains and make various modifications of Gram stain. 1.6 Describe the procedures for the different modifications of the Ziehl-Neelson method for acid-fast organisms. 1.7 Prepare stains and make various modification of the Ziehl-Neelson stain. 1.8 Describe the preparation of stains and the procedures for staining: i. Diphthera bacillus and volutin containing organisms ii. Spores	Lectures Practical Demonstrations Assignments Prepare fresh slides, stain slides/specimen Prepare stain, carry Gram staining procedure Prepare Ziehl Neelson stains Carry out Ziehl Neelson staining procedure. Prepare store stains, carry out spore staining. Prepare capsule stain, carry out capsule staining. Prepare stain lipids, polysaccharides, nuclear material and flagella.	Top loading balances Analytical balances Magnetic stirrers Hot plates Glassware/volumetric equipments Refrigerators Freezers Bunsen burner Gas tanks Microscopes Dark field microscope Phase contrast microscopes Fluorescent microscopes Black boards

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**

	iii. Capsule. iv. Intracellular lipids. v. Cell polysaccharides. vi. Nuclear materials. vii. Flagella. viii. Fungi. ix. Fungal spores (various types). x. Protozoa and spirochaetes. 1.9 Stain the cells and structures in 1.8 above.	Carry out staining for lipids, polysaccharides, nuclear materials and flagella. Prepare stains for fungal staining, protozoa and spirochetes. Carry out staining for fungi, fungal spores, protozoa and spirochetes.	Microscopes Slides Incubators

Week	**General Objectives: 2.0 Understand different sterilization techniques and their applications.**		
	Special Learning Objective	**Teachers Activities**	**Resources**

5 - 7	STERILIZATION TECHNIQUES 2.1 Sterilize various materials using dry heat e.g. hot air, oven, flaming etc. 2.2 Sterilize various materials using moist heat e.g. autoclave etc. 2.3 Sterilize used syringes or any other contaminated instruments. 2.4 Identify various control measures in the sterilizations in 2.1 – 2.3 above. 2.5 Sterilize contaminated room using fumigants. 2.6 Sterilize skin using dilute alcohols. 2.7 Sterilize different medical instruments using gases. 2.8 Describe the procedures for the maintenance of sterility 2.9 Describe the use of various irradiation techniques for sterilization. 2.10 Sterilize different materials by use of UV irradiation.	Lectures Practical sterilization of various items Assignments Carry out sterilization procedure by dry heat, moist heat, fumigation and irradiation.	Autoclave Steam generator Pressure cookers Cooking gas Bunsen burner UV lamps Hot air ovens Fumigation equipment Top loading balances Analytical balances Black boards.

Week	**General Objectives: 3.0 Understand the preparation and uses of different buffers, cell suspensions and dilution fluids.**		
	Special Learning Objective	**Teachers Activities**	**Resources**

8 - 10	PREPARATION AND USES OF BUFERS, CELL SUSPENSIONS, DILUTION FLUIDS 3.1 Explain the term "buffer". 3.2 Prepare suitable buffer systems for use in microbiology viz: i.) Citrate buffer systems ii.) Acetate buffer systems iii.) Citrate-phosphate buffer iv.) Veronal buffer v.) Boric acid-forax buffer vi.) Tris hel etc. 3.3 Explain the importance of oxidation-reduction potential in a growth medium. 3.4 Prepare distilled water and demineralized water. 3.5 Prepare the following suspension and dilution fluids: i.) Physiological saline ii.) Buffered saline iii.) Complex suspending media e.g. Kreb's ringer solution.	Lectures Practical Demonstrations Prepare different types of buffers. Check the pH of the buffers so prepared. Prepare distilled water Prepare complex media Use AAS	Black board pH meter Redox meter Atomic absorption Spectrophotometer Water distiller Water deionizer Top loading balance Analytical balance Glass ware/volumetric flasks Spectrophotometer.

Week	**General Objectives: 3.0 Understand safe practices in Biology and Microbiological laboratory**		
	Special Learning Objective	**Teachers Activities**	**Resources**

11-14	4.1 List possible hazards (infections) in the laboratory. 4.2 Explain safety rules and procedures in microbiology/biology laboratory. 4.3 Explain protective and first aid procedures in the laboratory. 4.4 Demonstrate the use of emergency equipment e.g. first aid kits, eye wash/irritation, fire extinguishers/hoods etc. 4.5 Explain universal precautions when working with blood and other body fluids.	Lectures Practicals Demonstrations Film shows	Black board Video equipment First aid kits and equipment Overhead projections

	Practical Content		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**

1-4	1. Prepare and stain films and smear of microorganisms and tissue sections. 2. Describe the preparation of stains and the procedures for the different modifications of Gram's staining techniques. 3. Prepare stains and make various modifications of Gram stain. 4. Describe the procedures for the different modifications of the Ziehl-Neelson method for acid-fast organisms. 5. Prepare stains and make various modification of the Ziehl-Neelson stain. 6. Stain cells and structures.	Prepare fresh slides, stain slides/specimen Prepare stain, carry Gram staining procedure Prepare Ziehl Neelson stains Carry out Ziehl Neelson staining procedure. Prepare store stains, carry out spore staining. Prepare capsule stain, carry out capsule staining. Prepare stain lipids, polysaccharides, nuclear material and flagella. Carry out staining for lipids, polysaccharides, nuclear materials and flagella. Prepare stains for fungal staining, protozoa and spirochetes. Carry out staining for fungi, fungal spores, protozoa and spirochetes.	- Top loading balances Analytical balances Magnetic stirrers Hot plates Glassware/volumetric equipments Refrigerators Freezers Bunsen burner Gas tanks Microscopes Dark field microscope Phase contrast microscopes Fluorescent microscopes Black boards**.** - Microscopes Slides Incubators

5-7	7. Sterilize various materials using dry heat e.g. hot air, oven, flaming etc. 7. Sterilize various materials using moist heat e.g. autoclave etc. 8. Sterilize used syringes or any other contaminated instruments. 10. Sterilize contaminated room using fumigants. 11. Sterilize skin using dilute alcohols. 11. Sterilize different medical instruments using gases. 13. Sterilize different materials by use of UV irradiation	Carry out sterilization procedure by dry heat, moist heat, fumigation and irradiation.	- Autoclave Steam generator Pressure cookers Cooking gas Bunsen burner UV lamps Hot air ovens Fumigation equipment Top loading balances Analytical balances Black boards.
8-10	14. Prepare suitable buffer systems for use in microbiology viz: i.) Citrate buffer systems ii.) Acetate buffer systems iii.) Citrate-phosphate buffer iv.) Veronal buffer v.) Boric acid-forax buffer vi.) Tris hel etc. 15. Prepare distilled water and demineralized water. 16.Prepare the following suspension and dilution fluids: i) Physiological saline ii) Buffered saline iii) Complex suspending media e.g. Kreb's ringer solution	Prepare different types of buffers. Check the pH of the buffers so prepared. Prepare distilled water Prepare complex media Use AAS	Black board pH meter Redox meter Atomic absorption Spectrophotometer Water distiller Water deionizer Top loading balance Analytical balance Glass ware/volumetric flasks Spectrophotometer.

11-14	17. Demonstrate the use of emergency equipment e.g. first aid kits, eye wash/irritation, fire extinguishers/hoods etc.	Lectures Practicals Demonstrations Film shows	Black board Video equipment First aid kits and equipment Overhead projections

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: MYCOLOGY

CODE: **STM 321**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 3

UNIT: **2.0**

GOAL: The aim of this course is to acquaint students with the morphological and physiological features of fungi and their economic importance.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Know the features, characteristics and modes of nutrition and reproduction in fungi.
2.0 Understand the classification and life cycles of fungi.
3.0 Understand economic importance of fungi.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MYCOLOGY		**Course Code: STM 321**	**Contact Hours: 1 – 0 - 3**
Week	**General Objectives: 1.0 Know the features, characteristics and modes of nutrition and reproduction**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 5	MORPHOLOGY OF FUNGI 1.1 Outline the scope of mycology giving examples of each type of fungus. 1.2 List the general characteristics of fungi. 1.3 Describe the general morphology of fungal cells. 1.4 List the major morphological and anatomical differences between fungal and green plant cells. 1.5 Prepare stains and make various modifications of Gram stain. 1.6 Examine known fungi under the microscope and draw and label the various morphological features. 1.7 Identify the various somatic structures in fungi. NUTRITION IN FUNGI 1.8 Describe the general modes of nutrition in fungi. 1.9 Describe the various laboratory methods of cultivating fungi. 1.10 Culture known-fungi on different media.	i. Lecture ii. Demonstrate slide preparation techniques for fungi. iii. Examine the prepared slides under L.P and H.P objectives. i) Describe media preparation for isolation of fungi e.g. PDA ii) Culture techniques for isolating fungi.	i. Binocular microscope ii. Media iii. Stains/Dyes iv. Incubators v. Glass ware (petri dishes, slides etc)

	1.11 Isolate pure cultures of fungi using selective and differential media. REPRODUCTION IN FUNGI 1.12 Describe the general modes of reproduction in fungi		

Week	**General Objectives: 2.0 Understand the classification and life cycles of fungi.**		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 11	CLASSIFICATION OF FUNGI 2.1 Describe the classification of fungi. 2.2 Describe the general characteristics of the phylum, divisions and classes of fungi. 2.3 Describe the detailed life cycle of at least two named members from each of the classes in 2.2 above. 2.4 Examine, identify and classify at least a member from each class listed in 2.2 above.	i) Lecture with the aid of manual diagram. ii) Examine prepared microscopic slides of reproductive and various stages of the life cycles of fungi.	i) Binocular microscopes ii) Charts iii) Prepared slides

Week	General Objectives: 3.0 Understand the economic importance of fungi		
	Special Learning Objective	**Teachers Activities**	**Resources**
12-14	ECONOMIC IMPORTANCE OF FUNGI 3.1 Describe the uses of fungi, in breweries, bread, wine making, cheese production. 3.2 Describe the agricultural importance of fungi as a source of food e.g. mushrooms, SCP, soil fertility improvement through the decomposition of organic material in soil. 3.3 Describe the industrial uses of fungi in commercial production of organic acids (citric and gallic acids) and certain drugs (orgometrine and cortisone) and antibiotics (penicillin, griseofulvin, cyclosporin). 3.4 Describe some medically important fungi and the mycoses they cause.	i) Lecture with examples ii) Isolate yeast from natural product and use the isolate to demonstrate fermentation in the laboratory.	Blackboard microscopes slides

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-5	1. Prepare stains and make various modifications of Gram stain. 2. Culture known-fungi on different media. 3. Isolate pure cultures of fungi using selective and differential media.	i) Describe media preparation for isolation of fungi e.g. PDA ii) Culture techniques for isolating fungi.	i. Binocular microscope ii. Media iii. Stains/Dyes iv. Incubators v. Glass ware (petri dishes, slides etc)

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: MICROBIOLOGICAL TECHNIQUES II

CODE: **STM 322**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 3

UNIT: **2.0**

GOAL: This course is designed to provide the student with a good knowledge of bacteria, its structure, taxonomy, nature and economic importance.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the preparation and uses of various media and cells involved in tissue and organ culture.
2.0 Understand the care and management of Experimental Animals.
3.0 Understand the procedures for preparation and preservation of stock cultures.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIOLOGICAL TECHNIQUES II		**Course Code: STM 322**	**Contact Hours: 1 – 0 - 3**
Week	**General Objectives: 1.0 Understand the preparation and uses of various media and cells involved in tissue and organ culture.**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 5	PREPARATION OF MEDIA AND CELLS FOR TISSUE AND ORGAN CULTURE 1.1 Prepare balanced salt solution (BSS) e.g. Hank's BSS, Dulbecco's PBS solution 'B', Phenol Red (1%) etc. 1.2 Collect fresh blood samples from calf or chicken. 1.3 Prepare serum from collected blood samples cells. 1.4 Check for sterility and toxicity of serum prepared in 3.1 above. 1.5 Prepare antibiotics, Trypsin, Agar for plaques used in tissue and organ culture. 1.6 Prepare a complex nutrient medium of Eagle's for tissue culture. 1.7 Prepare cell cultures from fresh tissues e.g. human amnion tissue culture. 1.8 Remove cells from glass containers using chelating agents or trypsin. 1.9 Describe procedures for preservation of prepared cells.	Lecture Practical Prepare balanced solution Check sterility of solutions Prepare antibiotic discs Prepare cell cultures from fresh tissues Remove cells from glass Preserve prepared cells	Top loading balances Microscopes Analytical balances pH meters Glasswares/Volumetric equipment Ionic meters Spectrophotometer Colorimeters Redox meters

Week	General Objectives: 2.0 Understand the care and management of Experimental Animals		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 9	CARE AND MANAGEMENT OF EXPERIMENTAL ANIMALS 2.1 List and describe the general principles observed in running an animal house e.g. diet, fluid, cleanliness etc. 2.2 Describe the procedures for caging, handling and breeding of various experimental animals e.g. rats, rabbits etc. 2.3 Describe human ways of killing laboratory animals. 2.4 Describe various ways of inoculating materials into experimental animals and breeding experimental animals. 2.5 Inoculate materials into experimental animals. 2.6 Bleed experimental animals. 2.7 Describe procedures for effecting necropsy in dead animals.	Lecture Practical Demonstration Inoculate materials into experimental animals. Bleed experimental animals Sacrifice experimental animals Carry out necropsy of dead animals	Cages Video equipment Animals house

Week	General Objectives: 3.0 Understand the procedures for preparation and preservation of stock cultures		
	Special Learning Objective	**Teachers Activities**	**Resources**
10-14	PREPARATION AND PRESERVATION OF STOCK CULTURES 3.1 Describe the procedures for isolation of pure cultures. 3.2 Isolate pure cultures in the laboratory. 3.3 Prepare stock cultures e.g. slab culture, lyophilize culture slants. 3.4 Describe methods of preservation of stock cultures e.g. lyophilization (freeze-drying), refrigeration, etc. 3.5 Preserve stock cultures in the laboratory. 3.6 Describe methods for the quality control of preserved culture. 3.7 Carry out quality assessment of preserved culture.	Practical Lecture Demonstration Assignment Carry out culture purification Prepare stock culture. Carry out freeze drying. Assess preserved culture for purity.	Black boards Autoclaves Freeze dryers Glassware Hot air ovens Microscopes

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-5	1. Prepare balanced salt solution (BSS) e.g. Hank's BSS, Dulbecco's PBS solution 'B', Phenol Red (1%) etc. 2. Collect fresh blood samples from calf or chicken. 3. Prepare serum from collected blood samples cells. 4. Check for sterility and toxicity of serum prepared in 3.1 above. 5. Prepare antibiotics, Trypsin, Agar for plaques used in tissue and organ culture. 6. Prepare a complex nutrient medium of Eagle's for tissue culture. 7. Prepare cell cultures from fresh tissues e.g. human amnion tissue culture. 8. Remove cells from glass containers using chelating agents or trypsin.	Prepare balanced solution Check sterility of solutions Prepare antibiotic discs Prepare cell cultures from fresh tissues Remove cells from glass Preserve prepared cells	Top loading balances Microscopes Analytical balances pH meters Glasswares/Volumetric equipment Ionic meters Spectrophotometer Colorimeters Redox meters
6-9	9. Inoculate materials into experimental animals. 10. Bleed experimental animals	Inoculate materials into experimental animals. Bleed experimental animals Sacrifice experimental animals Carry out necropsy of dead animals	Cages Video equipment Animals house

10-14	11. Isolate pure cultures in the laboratory. 12.Prepare stock cultures e.g. slab culture, lyophilize culture slants. 12. Describe methods of preservation of stock cultures e.g. lyophilization (freeze-drying), refrigeration, etc. 13. Preserve stock cultures in the laboratory. 14. Describe methods for the quality control of preserved culture. 15. Carry out quality assessment of preserved culture.	Carry out culture purification Carry out freeze drying. Assess preserved culture for purity	Black boards Autoclaves Freeze dryers Glassware Hot air ovens Microscopes

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: ENVIRONMENTAL MICROBIOLOGY

CODE: **STM 323**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 3

UNIT: **3.0**

GOAL: This course is designed to provide the student with a knowledge of the role of microbes in the environment.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Know the presence and effects of microorganisms on different environment.
2.0 Know the composition of the soil.
3.0 Know the various techniques of isolation of microorganisms.
4.0 Understand the role of microbes in the soil.
5.0 Know the various pollutants of the soil.
6.0 Understand the sources and analysis of water.
7.0 Understand eutrophication as resulting from water pollution by algae.
8.0 Know the various types of water borne diseases and their causative agents.
9.0 Understand the sources and effects of air polltants.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: ENVIRONMENTAL MICROBIOLOGY		**Course Code: STM 323**	**Contact Hours: 2 – 0 - 3**
Week	**General Objectives: 1.0 Know the presence and effects of microorganisms on different environment**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1	EFFECT OF MICROORGANISMS ON THE SOIL 1.1 Classify the environment. 1.2 Explain the factors affecting the presence of microorganisms in each environment. 1.3 Explain the effects of microorganisms on each environment.	Lectures Assignments Questions and answer techniques Field trips	pH meter Soil samplers Weighing balance

Week	**General Objectives: 2.0 Know the composition of the soil**		
	Special Learning Objective	**Teachers Activities**	**Resources**
2 - 3	COMPOSITION OF THE SOIL 2.1 Divide soil into five major constituents i.e mineral particles, organic residues, water, gases and biological systems. 2.2 Describe the microbial flora of the soil. 2.3 List and explain the conditions affecting the microbial population of the soil. 2.4 Explain the ecological interactions in the soil e.g. antagonism, predation.	Lecture Assignment Question and answer technique	Glass wares Microscopes Hot air oven Blast furnace Weighing balances

Week	**General Objectives: 3.0 Know the various techniques of isolation of microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 5	ISOLATION OF MICROORGANISMS FROM THE SOIL 3.1 Explain the soil as a culture medium. 3.2 Isolate microorganisms from the soil using selective and differential media. 3.3 Isolate autotrophic microorganisms by the scheme of Winogradky. 3.4 Isolate phototropic bacteria by membrane filtration method. 3.5 Identify some of the isolated microorganisms in 3.2 above.	Practical Lecture Assignment Question and answer Carry out isolation of microorganisms from soil. Carry out Winogradsky experiment. Isolate phototrophs. Carry out membrane filtration. Carry out experiment to identify bacteria	Black boards Hot air ovens Microscopes Incubators Water baths Wrist action shaker Hot plates Magnetic stirrer pH meters Weighing balances Membrane filtration kits

Week	General Objectives: 4.0 Understand the role of microbes in the soil		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 7	ROLE OF MICROBES IN THE SOIL 4.1 Explain biochemical activity of microorganisms on soil. 4.2 Explain the transformation of carbon compounds. 4.3 Explain the oxygen cycle. 4.4 Explain the transformation of nitrogen compounds. 4.5 List nitrogen fixing microorganisms. 4.6 Explain ammonification and nitrification. 4.7 Explain the oxidation of sulphur and sulphur compounds. 4.8 Explain phosphorous, iron and manganese cycles. 4.9 Explain the relationship between higher plants and soil microorganisms.	Lecture Assignment Question and answer	Black boards Over head projectors Video equipment

Week	General Objectives: 5.0 Know the various pollutants of the soil		
	Special Learning Objective	**Teachers Activities**	**Resources**
8 - 9	SOIL POLLUTANTS 5.1 Explain sources of pesticides, petroleum hydrocarbons and detergents polluting the soil. 5.2 Describe biodegradation of the pollutants in 5.1 above by soil microorganisms. 5.3 Explain persistence of the pollutants in 5.1 above and their effects on the biota e.g. biomagnification etc. 5.4 Describe the control of pollution by petroleum hydrocarbons. 5.5 Describe sources of metal pollution of the soil e.g. acid-mine drainage, microbial leaching etc. 5.6 Describe the control of metal pollution of the soil. 5.7 Describe the control of organophosphates and xenobiotics pollution of the soil. 5.8 Explain various methods for remediation of polluted soil e.g. reinsiation of crude oil polluted soil.	Lecture Assignment Question and answer	- do –

Week	General Objectives: 6.0 Understand the sources and analysis of water		
	Special Learning Objective	**Teachers Activities**	**Resources**
10-11	ANALYSIS OF WATER 6.1 Explain the occurrence and types of water including the hydrologic cycle. 6.2 List the properties of the aquatic environment. 6.3 Explain the properties of potable/polluted water. 6.4 Explain the various indices of water pollution. 6.5 Explain the terms sewage, BOD, COD, etc. 6.6 Determine the extent of water pollution applying various techniques e.g. MPN, membrane filter techniques etc. 6.7 Explain the system of water purification. 6.8 List international standards for drinking, recreational and factory water.	Practical Lecture Assignment Question and answer Excursion to water treatment plant Demonstration Carry out experiment to determine water pollution Carry out MPN technique	Black boards Incubators Water baths pH meters Membrane filtration kits Balances Multiple tubes COD digester Oven Glass ware BOD bottles Spectrophotometer Micro-sand filter beds

Week	General Objectives: 7.0 Understand Eutrophication as resulting from water pollution by algae		
	Special Learning Objective	**Teachers Activities**	**Resources**
12	EUTROPHICATION 7.1 Explain the term Eutrophication and the various algae involved. 7.2 List the sources of nutrients and factors responsible for evtrophication. 7.3 Explain the consequences of eutrophication on the Nations economy. 7.4 Describe the various methods of control of eutrophication.	Lecture Assignment Question and answer	Black boards Video equipment Computers/VCD equipment

Week	General Objectives: 8.0 Know the various types of water borne diseases and their causative agents		
	Special Learning Objective	**Teachers Activities**	**Resources**
13	WATER BORNE DISEASES 8.1 List the various water-borne diseases. 8.2 Describe the causative agents (organisms) in 8.1 above. 8.3 Explain the various sources of organisms in 8.2 above. 8.4 Describe the prevention and control of diseases in 8.1 above.	- do –	- do –

Week	General Objectives: 9.0 Understand the sources and effects of air pollutants		
	Special Learning Objective	**Teachers Activities**	**Resources**
14	AIR POLLUTANTS 9.1 Explain air pollutants due to chemical and microbial processes e.g. gaseous industrial effluents, methanogenesis, automobiles etc. 9.2 Identify the microbial indicators used in monitoring air pollution e.g. sulphur bacteria. 9.3 Describe the various methods of air sampling. 9.4 List the effects of air pollutants on man, plants and animals. 9.5 Describe the methods of controlling air pollution.	- do –	- do –

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
4-5	3.2 Isolate microorganisms from the soil using selective and differential media. 3.3 Isolate autotrophic microorganisms by the scheme of Winogradky. 3.4 Isolate phototropic bacteria by membrane filtration method	Carry out isolation of microorganisms from soil. Carry out Winogradsky experiment. Isolate phototrophs. Carry out membrane filtration. Carry out experiment to identify bacteria	Hot air ovens Microscopes Incubators Water baths Wrist action shaker Hot plates Magnetic stirrer pH meters Weighing balances Membrane filtration kits

10-11	6.6 Determine the extent of water pollution applying various techniques e.g. MPN, membrane filter techniques etc	Carry out experiment to determine water pollution Carry out MPN technique	Incubators Water baths pH meters Membrane filtration kits Balances Multiple tubes COD digester Oven Glass ware BOD bottles Spectrophotometer Micro-sand filter beds

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **FOOD MIROBIOLOGY**

CODE: **STM 324**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 2

UNIT: **2.0**

GOAL: This course is designed to provide the student with the knowledge of micro-organisms in food and their role in food spoilage, processing and preservation.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Know the sources of microbial contamination of food.
2.0 Understand the factors affecting microbial growth.
3.0 Know the techniques for the study of microorganisms.
4.0 Understand microbiological spoilage of specific foods.
5.0 Know the indices of food sanitation, microbiological standards and criteria.
6.0 Know the different types of food borne diseases.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: FOOD MICROBIOLOGY		**Course Code: STM 324**	**Contact Hours: 1 – 0 - 2**
Week	**General Objectives: 1.0 Know the sources of microbial contamination of food**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 3	SOURCES OF MICROBIAL CONTAMINATION OF FOOD 1.1 Identify the different microorganisms in the air. 1.2 Explain the mode of contamination of food by air borne microbes. 1.3 Identify the different microbes in the soil. 1.4 Describe the process of contamination of food by soil microbes. 1.5 Explain the importance of soil microbes in agriculture. 1.6 Identify the different types of microbes in water. 1.7 Explain the modes of contamination of food by water microbes. 1.8 Sample and test tap and stream water for bacterial contamination. 1.9 Explain the significance of some entero-bacteria in water testing. 1.10 List food poisoning and food spoilage organisms carried by man.	Lecture Expose general culture medium to air to isolate microbes. Collect soil samples from different location and culture to isolate soil microorganisms. Analyse water samples from different sources for microbes.	Media Glass ware Incubator Autoclave Colony counter Balances (analytical) Overhead projectors Inoculation hood Microscope with camera.

Week	**General Objectives:**		
	Special Learning Objective	**Teachers Activities**	**Resources**
	1.11 Describe food poisoning and food spoilage due to organisms carried by animals and animal products. 1.12 List other agents of food contamination e.g. insects, rodents etc. 1.13 Describe the symptoms of food poisoning and differentiate between food poisoning, food infection and food intoxication.		

Week	General Objectives: 2.0 Understand the factors affecting microbial growth		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 5	FACTORS AFFECTING MICROBIAL GROWTH 2.1 Define growth in bacteria. 2.2 Describe the microbial growth curve. 2.3 List and describe the chemical factors that affect microbial growth viz: 1. nutrient 2. pH 3. redox potential 4. antimicrobial agents 2.4 List and describe the physical factors that affect microbial growth viz: (i) temperature (ii) water activity (iii) relative humidity (iv) biological structure 2.5 List and describe the biotic factors that affect microbial growth viz: (i) growth rate (ii) metabolism (iii) antogonisms	Demonstrate the effect of environment factors on growth of microorganisms	Spectrophotometer Colorimeter Turbidimeter Shaker incubator Water bath Autoclave PH meter Refrigerator Cooled incubator Centrifuge

Week	General Objectives: 3.0 Know the techniques for the study of microorganisms		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 7	TECHNIQUES FOR THE STUDY OF MICROORGANISMS 3.1 Obtain various samples of foods for inoculation on growth media. 3.2 Select incubation conditions. 3.3 Inoculate the medium and incubate microorganisms. 3.4 Describe the cultural characteristics of the microbial colonies in 3.3 (shape, size, etc). 3.5 Isolate pure cultures from 3.3 above. 3.6 Test colonies for Gram's reaction and other stain reactions. 3.7 Carry out spore, flagella, and capsule staining techniques. 3.8 Examine the slides under the oil immersion lens of the microscope structures for morphological identification.	Cultivate bacteria Carry out isolation of pure culture from food samples Observe/identify isolates Carry out spore staining, flagella staining and capsule staining on the isolate. Observe and describe the samples.	Same as in 2.0 above

Week	General Objectives: 4.0 Understand microbiological spoilage of specific foods		
	Special Learning Objective	**Teachers Activities**	**Resources**
8 - 10	MICROBIOLOGICAL STUDY OF SPECIFIC FOODS 4.1 Identify microbial agents associated with the spoilage of the following groups of foods: (a) meat and meat products (b) poultry products (c) milk and dairy products (d) fermented food (e) baked food and confectionary products (f) fruits and vegetables (g) canned foods (h) dehydrated foods (i) sea foods (j) cereals and cereal products 4.2 Describe the sources and modes of contamination for each of the food groups in 4.1 above. 4.3 Describe storage conditions for preservation of each of the food groups listed in 4.1 above.	Lecture Demonstrate as above Carry out practical Take samples, culture and isolate	Same as in 2.0 above.

Week	General Objectives: 5.0 Know the indices of food sanitation, microbiological standards and criteria		
	Special Learning Objective	**Teachers Activities**	**Resources**
11-12	INDICES OF FOOD SANITATION 5.1 Describe problems encountered in direct examination of food for possible pathogens. 5.2 Describe the total plate count or mesophilic aerobes. 5.3 Carry out total plate count for mesophilic aerobes. 5.4 Describe the limitations of plate count. 5.5 Describe and carry out coliforms count with particular references to **E. coli** as a test of contamination. 5.6 Explain limitations of coliform tests as a test of contamination. 5.7 Describe total enthobacteriaceae count. 5.8 Describe pathogen as an index of food sanitation.	Lectures Carry out coliform count on selected food samples	- do –

Week	General Objectives: 6.0 Know the different types of food borne diseases		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	FOOD BORNE DISEASES 6.1 Describe the symptoms of food infection caused by: a. bacteria b. protozoans c. helminthes d. viruses 6.2 List various types of food poisoning and identify the causative organisms. 6.3 List various types of food borne diseases and describe their methods of transmission.	Lecture	- do –

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-3	1.8 Sample and test tap and stream water for bacterial contamination.	Analyse water samples from different sources for microbes.	Media Glass ware Incubator Autoclave Colony counter Balances (analytical) Overhead projectors Inoculation hood Microscope with camera.

6-7	3.3 Inoculate the medium and incubate microorganisms. 3.5 Isolate pure cultures from 3.3 above. 3.6 Test colonies for Gram's reaction and other stain reactions. 3.7 Carry out spore, flagella, and capsule staining techniques.	Cultivate bacteria Carry out isolation of pure culture from food samples Carry out spore staining, flagella staining and capsule staining on the isolate.	
11-12	5.3 Carry out total plate count for mesophilic aerobes	Carry out coliform count on selected food samples	

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **MICROBIOLOGY, PHYSIOLOGY AND METABOLISM**

CODE: **STM 325**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 2

UNIT: **3.0**

GOAL: This course is designed to provide the student with a knowledge of the various aspects of the physiology of Micro-organisms.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the molecular structure of microorganisms.
2.0 Understand the general requirements for microbial growth.
3.0 Know the various methods of measuring microbial growth.
4.0 Know the various sources of nitrogen.
5.0 Understand the various sources of carbon and energy to microorganisms and the effect of various concentration of the different carbon sources on microbial growth.
6.0 Understand solute transport processes in microorganisms.
7.0 Understand the various groups and nature of microbial enzymes.
8.0 Understand the basic principles of the various possible metabolic pathways adopted by microorganisms.
9.0 Understand the processes of biosynthesis in microorganisms.
10.0 Understand the basic principles underlying batch and continuous culture techniques, the advantages disadvantages and limitations of each system.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIOLOGY, PHYSIOLOGY AND METABOLISM		**Course Code: STM 325**	**Contact Hours: 2 – 0 - 2**
Week	**General Objectives: 1.0 Understand the molecular structure of microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 2	MOLECULAR STRUCTURE OF MICROROGANISMS 1.1 Describe the cell wall components of Gram-negative and Gram-positive bacteria. 1.2 Explain the Gram reaction. 1.3 Carry out staining of various organisms. 1.4 Describe the structure of cell membrane. 1.5 Describe the structure and components of cytoplasm. 1.6 Explain the various methods of microbial cell disruption. 1.7 Explain the separation of the components of disrupted cells. 1.8 Describe the surface appendages of the bacterial cell e.g. flagella, capsule, etc.	Lecture Question and answer technique Organize laboratory experiment on Gram stain Grade practical notebooks Demonstrate Carry out cell disruption Carry out Gram staining of **staphylococcus spp and E. coli**	Black board Microscope Sonic homogeniser French press Centrifuge

Week	General Objectives: 2.0 Understand the general requirements for microbial growth		
	Special Learning Objective	**Teachers Activities**	**Resources**
3	REQUIREMENTS FOR MICROBIAL GROWTH 2.1 Explain the concept of microbial growth as being increased in population/cell number/cell mass rather than increase in size of individual. 2.2 Describe the general requirements for microbial growth. 2.3 Explain the environmental factors that influence the growth of microorganisms. 2.4 Demonstrate the effects of some of the factors in 2.2 and 2.3 above on microbial growth. 2.5 Explain methods of measuring growth in microorganisms.	Lecture Carry out practical to show the effect of environmental factors on microbial growth Carry out culture of microorganisms under different bio-chemical condition	Blackboard Incubators Shaker Refrigerators Freezers Colorimeter Hot air ovens Analytical balance Spectrophotometer

Week	**General Objectives: 3.0 Know the various methods of measuring microbial growth**		
	Special Learning Objective	**Teachers Activities**	**Resources**
4	MEASUREMENT OF MICROBIAL GROWTH 3.1 Describe the direct methods of measuring microbial growth. 3.2 Describe the indirect methods of measuring microbial growth. 3.3 Describe the microbial growth curve. 3.4 Explain the mathematics of microbial growth.	Lecture Assignment Practical Measure biomass by the following methods: - dry cell weight - colony counting - colorimetry - spectrophotometry	As in 2.0 above

Week	**General Objectives: 4.0 Know the various sources of nitrogen**		
	Special Learning Objective	**Teachers Activities**	**Resources**
5	NITROGEN IN MICROBIAL GROWTH 4.1 Explain the importance of nitrogen in microbial growth. 4.2 List inorganic sources of nitrogen. 4.3 List organic sources of nitrogen.	Lecture Assignment Quiz	Blackboard

Week	**General Objectives: 5.0 Understand the various sources of carbon and energy to microorganisms and the effect of various concentration of the different carbon sources on microbial growth**		
	Special Learning Objective	**Teachers Activities**	**Resources**
6	CARBON SOURCES FOR MICROORGANISMS 5.1 Classify microorganisms according to mode of nutition (e.g. organotroph and lithotroph) 5.2 Describe monosaccharides as sources of carbon and energy. 5.3 Describe disaccharides as sources of carbon and energy. 5.4 Describe oligosaccharides as sources of carbon and energy. 5.5 Describe polysaccharides as sources of carbon and energy. 5.6 Describe derivatives of the various carbohydrates as sources of carbon and energy.	Lecture Assignment Demonstration	Blackboard Projectors Video equipment

Week	**General Objectives: 6.0 Understand solute transport processes in microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
7	SOLUTE TRANSPORT PROCESSES IN MICROORGANISMS 6.1 Explain the terms passive and active solute transport processes 6.2 Explain the nature and mechanisms involved in 6.1 above. 6.3 Describe the factors affecting 6.2 above. 6.4 Describe the various methods of studying transport processes in microorganisms.	- do –	- do –

Week	General Objectives: 7.0 Understand the various groups and nature of microbial enzymes		
	Special Learning Objective	**Teachers Activities**	**Resources**
8	MICROBIAL ENZYMES 7.1 Explain the general properties of enzymes. 7.2 Classify enzymes. 7.3 Explain the nature of microbial enzymes. 7.4 Describe the structure and the mechanisms of enzyme action. 7.5 Describe the location of enzymes in microbial cells. 7.6 Explain the factors affecting enzyme activity. 7.7 Explain the regulation of enzyme activity. 7.8 Explain constitution and inducible enzymes. 7.9 Describe the method of enzyme immobilization. 7.10 List and explain commercial uses of microbial enzymes. 7.11 Measure the activity of common enzyme amylase, protease etc.	Lecture Assignment Practical Demonstration Carry out enzyme activity to demonstrate amylase and protease activity	Spectrophotometer Glass ware Water bath Incubators Shakers

Week	**General Objectives: 8.0 Understand the basic principles of the various possible metabolic pathways adopted by microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
9 - 10	METABOLIC PATHWAYS 8.1 Explain Embden-Meyerhoff Panes (EMP) pathway. 8.2 Explain Hexose Monophosphate (HMP). 8.3 Explain the Entner-Duodoroff (ED). 8.4 Explain the Phosphoketolase pathway. 8.5 Explain combination of the pathways by any known microorganisms.	Lecture Demonstration	Computers VCD CD Rom Imaging equipment Charts

Week	**General Objectives: 9.0 Understand the processes of biosynthesis in microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
11-12	BIOSYNTHESIS IN MICROORGANISMS 9.1 Explain energy coupling in biosynthesis processes. 9.2 Describe the process of amino acid synthesis in microorganisms. 9.3 Describe the process of nucleic acid synthesis in microorganisms. 9.4 Describe the process of protein synthesis in microorganisms. 9.5 Estimate the protein content of bacteria. 9.6 Describe the synthesis of tetrapyrrodes, terpenes and B complex vitamins. 9.7 Describe the biosynthesis of lipids in microorganisms.	Lecture Tutorial Practical Carry out experiment to demonstration protein content of bacteria. Lyse bacteria cells. Carry out protein assay for solid protein and soluble protein.	Blackboard Charts Spectrophotometer pH meter Water bath Cenrifuge Sonicator Pressure press Kheldjal apparatus

Week	General Objectives: 10.0 Understand the basic principles underlying batch and continuous culture techniques, the advantages, disadvantages and limitations of each system		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	BATCH AND CONTINUOUS CULTURE TTECHNIQUES 10.1Explain the term batch culture. 10.2Explain the effect of nutrient depletion in 10.1 above. 10.3Explain the effect of pH changes in 10.1 above. 10.4Explain the effect of temperature changes in 10.1 above. 10.5Explain the effect of toxic metabolites on 10.1 above. 10.6Explain the commercial uses of batch culture systems. 10.7Explain the basic concept of continuous culture. 10.8Describe the chemo stat. 10.9Describe the turbidostat. 10.10 Explain the elementary mathematical principles of chemo stat. 10.11 Explain the control of population density and growth rate in chemo stat. 10.12 Explain the industrial uses of continuous culture techniques.	Lecture Question and answer technique	Blackboard

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-2	1.3 Carry out staining of various organisms	Carry out cell disruption Carry out Gram staining of **staphylococcus spp and E. coli**	
3	2.5 Demonstrate the effects of environmental factor on microbial growth.	Carry out practical to show the effect of environmental factors on microbial growth Carry out culture of microorganisms under different bio-chemical condition	Blackboard Incubators Shaker Refrigerators Freezers Colorimeter Hot air ovens Analytical balance Spectrophotometer
11-12	9.3 Carry out the process of nucleic acid synthesis in microorganisms. 9.4 Carry out the process of protein synthesis in microorganisms	Carry out experiment to demonstration protein content of bacteria. Carry out protein assay for solid protein and soluble protein	Blackboard Charts Spectrophotometer pH meter Water bath Cenrifuge Sonicator Pressure press Kheldjal apparatus

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **VIROLOGY**

CODE: **STM 326**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 2

UNIT: **3.0**

GOAL: This course is designed to enable the student understand the biology of viruses and their roles in the various environments.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Know the historical development of Virology as a science.
2.0 Understand the structural, physiochemical and pathogenic properties of viruses.
3.0 Understand the criteria for viral classification.
4.0 Know the stages of viral replication and attendant genetic phenomena.
5.0 Know the various materials and methods employed in cultivating viruses in the laboratory.
6.0 Understand qualitative and quantitative methods of virus estimation of viruses.
7.0 Know the pathogenesis and prevention of viral infections in plants and animals.
8.0 Know the important industrial viruses and the preparation of some viral vaccines.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: VIROLOGY		**Course Code: STM 326**	**Contact Hours: 2 – 0 - 2**
Week	**General Objectives: 1.0 Know the historical development of Virology as a science**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1	HISTORICAL DEVELOPMENT OF VIROLGY 1.1 Describe Lauis Pasteurs experiments andobservations. 1.2 Describe the development of the porcelain filter by Chamberlain (1884). 1.3 Explain Loeffler and Frosch's woeks on foot and mouth disease virus. 1.4 Explain Beijerink's observation on TMV (1898). 1.5 Explain Stanley's studies on TMV (1935). 1.6 Explain Twort's works on bacteriophages (1915).	Lectures with illustrated examples.	Charts, manuals etc.

Week	General Objectives: 2.0 Understand the structural, physiochemical and pathogenic properties of viruses		
	Special Learning Objective	**Teachers Activities**	**Resources**
2 - 3	PROPERTIES OF VIRUSES 2.1 Describe the variations in size and shape of plant, animal and bacterial viruses especially the architectural organization of their capside. 2.2 Describe nucleic acid types and the arrangement of units of the protein coat in viruses named in 2.1 above. 2.3 Explain the crystallization of viruses.	Lecture	Overhead projectors Micrographs, charts.

Week	General Objectives: 3.0 Understand the criteria for viral classification		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 5	VIRAL CLASSIFICATION 3.1 Explain the problems encountered in viral classification. 3.2 Explain viral classification based on host range and made of transmission. 3.3 Explain viral classification based on type of viral nucleic acid. 3.4 Explain viral classification based on size and morphology, including type of symmetry, number and arrangement of capsomeres and presence of membranes (envelope). 3.5 Explain viral classification based on pathology including inclusion body formation, nature of cytopathic effects (CPE) and symptomatology. 3.6 Classify viruses based on susceptibility to physical and chemical agents e.g. ether, formaldehyde etc. 3.7 Classify viruses based on immunological properties.	Lectures with prepared election micrographs	Overhead projectors Micrographs, charts.

Week	General Objectives: 4.0 Know the stages of viral replication and attendant genetic phenomena		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 7	VIRAL REPLICATION 4.1 Explain the various modes of viral attachment to and entry into host cells (plants and animals). 4.2 Explain the eclipse phase. 4.3 Explain the synthesis and assemblage of new viral macromolecules. 4.4 Explain modes of progery in virus releases. 4.5 Define one-step virus multiplication curve. 4.6 Explain lysogeny and properties of the lysogenic system. 4.7 Explain transduction completion and phenotypic mixing.	Lecture	Computer VCD CD Rom Imaging equipment

Week	General Objectives: 5.0 Know the various materials and methods employed in cultivating viruses in the laboratory		
	Special Learning Objective	**Teachers Activities**	**Resources**
8	CULTIVATION OF VIRUSES IN THE LABORATORY 5.1 Explain the difficulties involved in the cultivation of viruses in the laboratory. 5.2 List and explain the techniques for cultivation of viruses. 5.3 List the safety procedures adopted during viral cultivation and isolation. 5.4 Describe the use of animals, plants and bacteria for growth and isolation. 5.5 Inoculate viruses into animals and plant hosts. 5.6 Inoculate and cultivate viruses using egg techniques e.g. yolk sac, chorioallantoic, allantoic and amniotic inoculation. 5.7 Harvest egg fluids and membranes for viral studies. 5.8 Prepare and use various viral growth and maintenance media. 5.9 Prepare and use cell cultures for viral cultivation. 5.10 Explain the techniques for viral preservation.	Lecture Demonstrate inoculation of fertilized egg and membranes Demonstrate the insulation of exptal animals Prepare tissue cultures and cell culture media	Syringes and needles Dissecting sets Tissue culture flasks Refrigerated centrifuge Incubator Freeze dryer

Week	General Objectives: 6.0 Understand qualitative and quantitative methods of virus estimation of viruses		
	Special Learning Objective	**Teachers Activities**	**Resources**
9 - 10	ESTIMATION OF VIRUSES 6.1 Explain the principles of direct visual counting of viruses using electron microscope. 6.2 Estimate viruses by titration, phage typing and phage assay. 6.3 Explain the principles and techniques of neutralization tests in animals and tissue cultures. 6.4 Explain the principles and methods of Haemagglutination (HA) and haemagglutination inhibition (HI), haemabsorption tests. 6.5 Prepare various suitable buffers e.g. veronal buffer, barbitone, saline buffer and sheep blood for complement fixation test. 6.6 Carry out preparation and titration of haemolysin 6.7 Prepare indicator system (used for CFT). 6.8 Carry out complement fixation test proper.	Lecture Demonstrate isolation of bacteriophage from sewage sample Demonstrate plaque formation Demonstrate haemagglutination tests	Membrane filtration unit Vacuum pump Experimental animals

Week	General Objectives: 70 Know the pathogenesis and prevention of viral infections in plants and animals		
	Special Learning Objective	**Teachers Activities**	**Resources**
11- 12	PREVENTION OF VIRAL INFECTIONS IN PLANTS AND ANIMALS 7.1 List viral diseases of plants e.g TMV, cassava virus. 7.2 List viral diseases of man and animals e.g polio, small pox, new castle, foot and mouth diseases, rabies. 7.3 Identify the modes of transmission of pathogenic viruses emphasizing the role of vectors. 7.4 Explain viral virulence emphasizing the factors that determine host cell susceptibility. 7.5 Explain the symptomatiologies of viral diseases in plants. 7.6 Explain the symptomatiologies of human and animal viral diseases. 7.7 Explain the role of humoral and cellular immune responses in protection and recovery from viral infections. 7.8 Identify the roles of interferon and chemical principles in combating viral infections. 7.9 Explain the application of radiation, heat and quarantine measures in the prevention of viral infections as may be applicable to man, animals and plants.	Lectures with examples. Demonstrate cytopathetic effect of viruses on plants and animals (where possible)	Experimental animals

Week	General Objectives: 8.0 Know the important industrial viruses and the preparation of some viral vaccines		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	VIRUSES AND INDUSTRY 8.1 Explain the economic losses due to viral infections of bacteria, plants and animals. 8.2 List the common medical and veterinary viral vaccines. 8.3 Explain the preparation of chick embryo viral vaccine. 8.4 Explain the preparation of a tissue culture viral vaccine. 8.5 Explain the preparation of an egg fluid/egg membrane viral vaccine.	Lectures with examples Excursion to vaccine production facilities (Vom and yaba)	- do –

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
8	5.6 Inoculate and cultivate viruses using egg techniques e.g. yolk sac, chorioallantoic, allantoic and amniotic inoculation. 5.7 Harvest egg fluids and membranes for viral studies. 5.8 Prepare and use various viral growth and maintenance media. 5.9 Prepare and use cell cultures for viral cultivation.	Lecture Demonstrate inoculation of fertilized egg and membranes Demonstrate the insulation of exptal animals Prepare tissue cultures and cell culture media	Syringes and needles Dissecting sets Tissue culture flasks Refrigerated centrifuge Incubator Freeze dryer
9-10	6.5 Prepare various suitable buffers e.g. veronal buffer, barbitone, saline buffer and sheep blood for complement fixation test. 6.6 Carry out preparation and titration of haemolysin 6.7 Prepare indicator system (used for CFT). 6.8 Carry out complement fixation test proper.	Demonstrate isolation of bacteriophage from sewage sample Demonstrate plaque formation Demonstrate haemagglutination tests	Membrane filtration unit Vacuum pump Experimental animals

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **MICROBIAL GENETICS**

CODE: **STM 411**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 0

UNIT: **2.0**

GOAL: This course is designed to provide the student with a good knowledge of genetics and its application in microbiology.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand basic nature and structure of the genetic material of bacteria and other microorganisms.
2.0 Understand the basic structure of nucleic acids in relation to genetics of microorganisms.
3.0 Understand the basic nature and functions of the informational macromolecules – DNA and RNA.
4.0 Understand the concept of Mutation.
5.0 Understand modifications that can occur in microorganisms.
6.0 Understand the applications of microbial genetic concepts in biotechnology (genetic engneering)

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIAL GENETICS		**Course Code: STM 411**	**Contact Hours: 2 – 0 - 0**
Week	**General Objectives: 1.0 Understand basic nature and structure of the genetic material of bacteria and other microroganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 2	NATURE OF CHROMOSOMES 1.1 Explain the haploid nature of prokaryotic chromosomes. 1.2 Describe circular bacterial chromosomes. 1.3 Describe extra chromosomal genetic elements found in the bacterial cells. 1.4 Explain the advantages of the simple and haploid nature of bacterial chromosomes in genetic studies. 1.5 Explain the nature of eukaryotic chromosomes, paying particular attention to their properties and functions.	Lectures with examples	Blackboards Over head projector VCD/Video equipment Computer equipment

Week	General Objectives: 2.0 Understand the basic structure of nucleic acids in relation to genetics of microorganisms		
	Special Learning Objective	**Teachers Activities**	**Resources**
3 - 5	STRUCTURE OF NUCLEI ACIDS 2.1 Explain Nucleic acid as polynucleotides. 2.2 Explain the basic structure of a nucleotide. 2.3 Describe the kinds of sugar in a nucleotide. 2.4 Describe the groups of nitrogenous organic bases. 2.5 Explain the importance of phosphodiestes and hydrogen bonds in the polynucleotides. 2.6 Describe the structures of DNA and RNA. 2.7 Explain the major differences between DNA and RNA. 2.8 Describe replication in DNA and transcription in RNA.	Lectures	- do –

Week	General Objectives: 3.0 Understand the basic nature and functions of the informational macromolecules – DNA and RNA.		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 7	NATURE AND FUNCTIONS OF DNA AND RNA 3.1 Explain the meaning of the genetic code as it relates to the sequence of bases on the DNA molecule. 3.2 Explain the template nature, the degeneracy of the genetic code and the wobble hypothesis. 3.3 Explain the non-overlapping nature of the genetic code. 3.4 Describe the various types of RNA. 3.5 Explain the relationships between DNA and the different types of RNA in protein synthesis. 3.6 Explain amino acids the building blocks of protein. 3.7 Describe the steps in protein synthesis. 3.8 Explain the importance of formyl methiomine in chain initiation and termination. 3.9 Explain the RNA as the genetic material in some viruses.	- do –	- do –

Week	General Objectives: 4.0 Understand the concept of Mutation		
	Special Learning Objective	**Teachers Activities**	**Resources**
8 - 9	MUTATION 4.1 Explain the meaning of mutation as it relates to microorganisms. 4.2 Explain spontaneous mutation. 4.3 Explain induced mutation. 4.4 Explain mutation rates. 4.5 Explain the factors affecting mutation rates. 4.6 Describe the various kinds of mutants. 4.7 Explain the selection and detection of mutants. 4.8 Describe the various techniques for isolating mutants e.g. (i) isolation of antibiotic resistant mutants (ii) isolation of nutritional autotrophs 4.9 Describe mutogens and their effects. 4.10 Explain the molecular basis of mutation. 4.11 Explain the mechanisms of the action of mutogens. 4.12 Explain mutation and microbial evolution. 4.13 Explain DNA repairs	Lecture Demonstrate mutation by: (i) replica plating technique (ii) gradient plate technique	Velveteen stamp pads Glass ware

Week	General Objectives: 5.0 Understand modifications that can occur in microorganisms		
	Special Learning Objective	**Teachers Activities**	**Resources**
10-13	MODIFICATION IN MICROORGANISMS 5.1 Explain phenotypic and genotypic changes. 5.2 Explain the concept of genetic recombination in microorganisms (bacteria and fungi). 5.3 Explain types of genetic recombination in microorganisms (bacteria and fungi). 5.4 Explain transformation in bacteria under the following: (i) preparation of transformation in bacteria (ii) competence (iii) ceptake of RNA (iv) integration of incorporated DNA 5.5 Explain transformations as a tool in molecular genetics. 5.6 Describe occurrences of transformation in nature. 5.7 Explain the mechanism of transformation. 5.8 Describe the various types of transformation. 5.9 Explain the term lysogenic conversion. 5.10 Explain the mechanism of conjugation. 5.11 Differentiate between Hfr and F-factor.	Lecture	Chalkboard Charts

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**
	5.12 Identify plasmids that act as extra chromosomal genetic element. 5.13 Explain transfer and curing of plasmids. 5.14 Describe resistance-transfer factors and Bacteriocuris and cryptic plasmids as examples of plasmids. 5.15 Explain mitochondrial inheritance in yeasts.		

Week	General Objectives: 6.0 Understand the applications of microbial genetic concepts in biotechnology (genetic engineering)		
	Special Learning Objective	**Teachers Activities**	**Resources**
14	MICROBIAL GENETICS IN BIOTECHNOLOGY 6.1 Explain the terms biotechnology and genetic engineering. 6.2 Describe the various types of endonucleoses and their importance in genetic engineering and biotechnology. 6.3 Explain the importance of vectors and host cells in genetic engineering. 6.4 Outline the steps in the ioning of genes and protoplast fusion. 6.5 Explain how useful product would be obtained from genetically engineered cells (protein, hormones, bioconversions, bioremediations etc). 6.6 Explain hybridonias and methods of their isolation.	Lecture and demonstrate using charts, diagrams	Chalkboard Charts

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **MICROBIOLOGICAL TECHNIQUES III**

CODE: **STM 412**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 3

UNIT: **2.0**

GOAL: This course is designed to further develop the students' ability in techniques allied to microbiological assays.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the use of various fluorescent dyes in the detection of serum antibodies.
2.0 Understand the techniques involved in the operation of membrane filter.
3.0 Understand the principles and techniques involved in the use of anaerobic jar.
4.0 Understand the various measurements, comparisons and standardizations in routine laboratory work..

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIOLOGICAL TECHNIQUES III		**Course Code: STM 412**	**Contact Hours: 1 – 0 - 3**
Week	**General Objectives: 1.0 Understand the use of various fluorescent dyes in the detection of serum antibodies**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 3	IMMUNOFLOURESCENT TECHNIQUES 1.1 Identify the various fluorescent microscopes. 1.2 Describe the various steps involved in fluorescent microscopy. 1.3 Draw and describe the various organelles within the cell. 1.4 Explain the theory of formation of certain structures such as vacuoles, cell wall etc.	Lectures Practicals Mark and grade practical books	Blackboards Fluorescent Microscope Slides

Week	**General Objectives: 2.0 Understand the techniques involved in the operation of membrane filter**		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 6	TECHNIQUES OF THE MEMBRANE FILTRATION 2.1 Explain membrane filtration. 2.2 Describe the various types of membrane filters. 2.3 Describe the components of membrane filtration. 2.4 Describe the techniques involved in membrane filtration. 2.5 Apply membrane filtration to: (i) water (ii) specialized media (iii) serum 2.6 Describe the advantages of membrane filtration over other microbiological techniques e.g. multiple tube fermentation.	Lectures Practicals Mark and grade practical books Carry out membrane filtration of select fluids	Blackboard Membrane filters Test tubes Membrane filter kits

Week	General Objectives: 3.0 Understand the principles and techniques involved in the use of anaerobic jar		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 10	ANAEROBIC INCUBATION 3.1 Explain the principle of anaerobic incubation. 3.2 Describe the components of the standard anaerobic jar. 3.3 Explain the use of cold and warm catalysts in an anaerobic jar. 3.4 Prepare indicator system for use in an anaerobic jar. 3.5 Explain the advantages of the gaspak over the conventional equipment. 3.6 Cultivate anaerobic organisms using anaerobic jar.	- do – Prepare indicator system Carry out anaerobic culture of bacteria	Blackboards Anaerobic jars Vacuum pumps Gas cylinder

Week	General Objectives: 4.0 Understand the various measurements, comparisons and standardizations in routine laboratory work		
	Special Learning Objective	**Teachers Activities**	**Resources**
11-14	BIOLOGICAL STANDARDIZATION 4.1 Explain the need for biological standardization. 4.2 List and explain microbiological units of measurements. 4.3 Explain the term "bioassay". 4.4 Describe the procedures involved in bioassay. 4.5 Describe the various bioassay methods e.g direct and indirect. 4.6 Measure virulence in vivo applying various methods e.g Reed and Muench etc. 4.7 Describe procedures for the preparation of antibiotic discs. 4.8 Prepare and utilize antibiotic discs.	- do – Carry out Reed and Muench assay Carry out experiments to prepare antibiotic disc. Cut discs Soak the discs Estimate the concentration of antibiotic per disc.	Blackboard Charts Overhead projector

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
7-10	3.5 Cultivate anaerobic organisms using anaerobic jar.	Prepare indicator system Carry out anaerobic culture of bacteria	Blackboards Anaerobic jars Vacuum pumps Gas cylinder
	4.8 Prepare and utilize antibiotic discs	Carry out Reed and Muench assay Carry out experiments to prepare antibiotic disc. Cut discs Soak the discs Estimate the concentration of antibiotic per disc.	Blackboard Charts Overhead projector

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **PHARMACEUTICAL MICROBIOLOGY**

CODE: **STM 413**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 2

UNIT: **3.0**

GOAL: This course is designed to provide the student with a knowledge of the importance of microbes in the pharmaceutical industry.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Outline the scope of pharmaceutical microbiology.
2.0 Know the various sources of drugs and the importance of microorganisms in the pharamaceutical industry.
3.0 Understand the role of microorganisms as the main sources of antibiotics.
4.0 Understand the general principles and mechanisms of action of the various kinds of antimicrobial agents.
5.0 Understand the factors that determine the sensitive or resistance to antibiotics by microorganisms.
6.0 Understand the principles involved n the microbiological assay of antimicrobial agents.
7.0 Know the role of microorganism in the production of vitamins and amino acids.
8.0 Understand drug tolerance and addiction an the factors governing them.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: PHARMACEUTICAL MICROBIOLOGY		**Course Code: STM 413**	**Contact Hours: 2 – 0 - 2**
Week	**General Objectives: 1.0 Outline the scope of pharmaceutical microbiology**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1	SCOPE OF PHARMACEUTICAL MICROBIOLOGY 1.1 Explain the general principles of drug production. 1.2 Explain the general principles of drug action. 1.3 Outline the laws regulating the production, scale and uses of drugs. 1.4 Outline microbiological standards in the pharmaceutical industry.	Lectures Conduct visit to pharmaceutical establishments	Blackboards Over head projectors

Week	**General Objectives: 2.0 Know the various sources of drugs and the importance of microorganisms in the pharmaceutical industry**		
	Special Learning Objective	**Teachers Activities**	**Resources**
2	MICROORGANISMS IN PHARMACEUTICAL INDUSTRY 2.1 Identify plant courses of drugs. 2.2 Identify animal sources of drug. 2.3 Identify microbial sources of drugs. 2.4 Explain synthesis drugs. 2.5 Differentiate between drugs from sources 2.1 to 2.3 and drugs from 2.4. 2.6 Explain the role of microorganisms in the spoilage of drugs.	Lectures Show students plants with medicinal properties e.g. Neem **(Azadicharita indica)**	Plant materials

Week	General Objectives: 3.0 Understand the role of microorganisms as the main sources of antibiotics

	Special Learning Objective	Teachers Activities	Resources
3 - 4	MICROBIAL ANTIBOITICS 3.1 Describe the production of penicillin antibiotic from microbial sources. 3.2 Explain the semi-synthetic production of penicillin. 3.3 Explain the modifications of the basic structure of penicillin to produce other antibiotics. 3.4 Describe the production of Cephalosporins. 3.5 Describe the production of Streptomycin and related antibiotics. 3.6 Describe the production of Tetracycline. 3.7 Describe the production of Chloramphenicol. 3.8 Describe the production of antibiotics from Bacillus spp. 3.9 Describe production of synthetic antibiotics.	Lectures Attempt to isolate soil microorganism with antibiotic properties Test their antibiotic activity	Petri dishes Media Multo-disc Filter paper Antibiotics

Week	General Objectives: 4.0 Understand the general principles and mechanisms of action of the various kinds of antimicrobial agents		
	Special Learning Objective	**Teachers Activities**	**Resources**
5 - 6	MODE OF ACTION OF ANTIMICROBIAL AGENTS 4.1 Define the following terms:. (i) antimicrobial agents (ii) antibiotic spectrum (iii) bacterio static activity (iv) bacteriocidal activity (v) antiseptics/disinfectants 4.2 Explain antibiotic synergism and antagonism. 4.3 Explain the mode of action of antibiotics on cell wall synthesis. 4.4 Explain the mode of action of antibiotics on cell membrane. 4.5 Explain the mode of action of antibiotics that inhibit protein synthesis. 4.6 Explain the mode of action of antifungal agents. 4.7 Explain the mode of action of sulphonamides. 4.8 List the qualities of a good disinfectant/antiseptic. 4.9 Explain the mode of action of disinfectant. 4.10 Explain the factors that affect the mode of action of disinfectant/antiseptics.	Lectures Demonstrate antibiotic sensitivity using paper, disc and MIC Demonstrate antimicrobial properties of common disinfectants/antiseptics	- do – same as above

Week	**General Objectives:**		
	Special Learning Objective	**Teachers Activities**	**Resources**
	4.11 Describe the various methods of testing for efficiency of disinfectants/antiseptics.		
Week	**General Objectives: 5.0 Understand the factors that determine the sensitive or resistance to antibiotics by microorganisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 8	ANTIBIOTIC RESISTANCE 5.1 Explain susceptibility/resistance of microorganisms to different antibiotics. 5.2 List factors that can affect susceptibility/resistance of microorganisms to antimicrobial agent. 5.3 Explain changes in susceptibility/resistance of microorganisms to antimicrobial agents with length of treatment. 5.4 Explain the effects of age, nutritional factors, temperature, pH and water activity on susceptibility/resistance by microorganisms. 5.5 Test for microbial susceptibility/resistance to antibiotics using various techniques. 5.6 Explain the resistance of microorganisms to antibiotics due to genetic factors of chromosomal origin. 5.7 Explain resistance due to genetic factors of extra-chromosomal origin (Plasmids).	Lectures Demonstrate the effect of physiochemical factors on the susceptibility/resistance of microorganisms to some antibiotics. Carry out antibiotic sensitivity tests Carry out MIC tests	Same as above

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**
	5.8 Explain resistance due to non-genetic factors.		

Week	General Objectives: 6.0 Understand the principles involved in the microbiological assay of antimicrobial agents		
	Special Learning Objective	**Teachers Activities**	**Resources**
9 - 10	MICROBIOLOGICAL ASSAY 6.1 Explain though term Biological Potency. 6.2 Explain the physical and chemical methods of assay. 6.3 Describe the microbiological methods of assay of antimicrobial agents. 6.4 Explain the units of measurement in assay. 6.5 Carry out a microbiological assay using a given sample e.g. blood, serum, urine and tissue fluid.	Lectures Carry out microbiological assay to demonstrate bioactivities	

Week	General Objectives: 7.0 Know the role of microorganism in the production of vitamins and amino acids		
	Special Learning Objective	**Teachers Activities**	**Resources**
11-12	MICROORGANISMS IN THE PRODUCTION OF VITAMINS AND AMINO ACIDS 7.1 Explain the general principles of vitamin synthesis. 7.2 Describe vitamin B_2 synthesis by **Pseudomonas** spp. 7.3 Describe vitamin B_2 synthesis by **Ashbya gossypii** and **Eremothecium ashbyii**. 7.4 Describe the principles of amino acid synthesis. 7.5 Describe L-Lysine production by **E. coli** combined with **Aerobacter aerogenes**. 7.6 Describe L-Glutamin acid production by **Micrococcus**; **Arthrobacter** and **Brevibacterium** spp. 7.7 Explain the advantages of L-form of amino acids produce by microbes.	Lectures	

Week	General Objectives: 8.0 Understand drug tolerance and addiction an the factors governing them		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	DRUG TOLERANCE, ABUSE AND ADDICTION 8.1 Define the terms (i) tolerance (ii) abuse (iii) addiction 8.2 Explain the individual responses to drugs. 8.3 Explain the factors affecting drug disposition in the body e.g. age, diet, physiological state etc. 8.4 Describe the different types of drug abuse. 8.5 Explain the characteristics of drug addicts. 8.6 Explain addiction to the central nervous system (CNS) by stimulants/depressants. 8.7 Describe different methods of control of drug abuse and addiction.	Lectures Conduct visit to drug addiction rehabilitation centre	

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
7-10	6.5 Carry out a microbiological assay using a given sample e.g. blood, serum, urine and tissue fluid.	Carry out microbiological assay to demonstrate bioactivities	

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **PATHOGENIC MICROBIOLOGY**

CODE: **STM 414**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 3

UNIT: **3.0**

GOAL: This course is designed to provide the student with the knowledge of microorganism as causes of disease.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the pattern of Host-Parasite Relations in microbial and parasitic infections.
2.0 Know various pathogenic organisms.
3.0 Know the various bacterial, fungal, viral and protozoan infections of man and animals particularly in Nigeria.
4.0 Know methods of prevention, control and therapy of various bacterial, fungal, viral and protozoan infections.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: PATHOGENIC MICROBIOLOGY		**Course Code: STM 414**	**Contact Hours: 2 – 0 - 3**
Week	**General Objectives: 1.0 Understand the pattern of Host-Parasite Relations in microbial and parasitic infections**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 4	HOST/PARASITE RELATIONS 1.1 Explain the concept of infection, pathogenicity and virulence with respect to disease development in plants, animals and man. 1.2 Explain virulence factors in pathogenic bacteria and fungi of plants, animals and man. 1.3 Explain virulence factors in pathogenic viruses of plants, animals and man. 1.4 Test for virulence using different methods. 1.5 Explain the role of bacteria phages in viral infections. 1.6 Describe the mode of entry and general symptoms of some parasitic infections of plants, animals and man.	Lectures with examples Demonstrate virulence by inoculating experimental animals with different concentrations of a pathogen.	Experimental animals

Week	**General Objectives: 2.0 Know various pathogenic organisms**		
	Special Learning Objective	**Teachers Activities**	**Resources**
5 - 6	PATHOGENIC ORGANISMS 2.1 List the common pathogenic bacteria along with the diseases they cause in plants, animals and man. 2.2 List the common pathogenic fungi along with the diseases they cause in plants, animals and man. 2.3 List the common pathogenic viruses along with the diseases they cause in plants, animals and man. 2.4 Explain "Zoonoses" and relate it to 2.1 – 2.3 above. 2.5 Identify the common pathogenic microorganism listed in 2.1 – 2.3 above. 2.6 Observe/describe the symptoms / lesions of the diseases caused by the pathogens listed in 2.1 – 2.3 above, where possible.	Lectures with examples Demonstrate the examples of bacteria, viruses, fungi and protozoan with prepared slides.	Microscopes Prepared slide charts, manual colored atlas.

Week	General Objectives: 3.0 Know the various bacterial, fungal, viral and protozoan infections of man and animals particularly in Nigeria		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 10	BACTERIAL INFECTIONS 3.1 Describe the causative agents, symptoms, sources, transmission, modes of infection, incubation and laboratory diagnoses of common bacterial infections of man, animals and plants (a) gastro-intestinal tract (GIT) infections (b) urinary tract infections (UTI) and STD's (c) skin infections (including wounds). (d) Other infections e.g plant tumors. FUNGAL INFECTIONS 3.2 Describe the causative agents, symptoms, sources, transmission, modes of infection, incubation and laboratory diagnoses of common fungal infections in man, animals and plants (a) mycoses (b) desmatophycoses (c) others e.g. downing mildew VIRAL INFECTIONS 3.3 Describe the causative agents, symptoms, sources, transmission, modes of infection, incubation and laboratory diagnoses of common viral infections of animals, man and plants (a) measles (b) poliomyelitis (c) necocastle disease (d) rinderpost (e) others e.g. tobacco mosaic virus infection	Lectures Same as above	As above

Week	General Objectives:		
	PROTOZOAN INFECTIONS 3.4 Describe the causative agents, symptoms, sources, transmission, modes of infection, incubation and laboratory diagnoses of common protozoan infections of man, animals and plants (a) Dysentery (amoebiasis) (b) Diarrhoea (due to flagellates) e.g giardiasis (c) Others e.g. nematode infections		

Week	General Objectives: 4.0 Know methods of prevention, control and therapy of various bacterial, fungal, viral and protozoan infections		
	Special Learning Objective	**Teachers Activities**	**Resources**
11-14	PREVENTION, CONTROL, THERAPY OF VARIOUS INFECTIONS 4.1 Explain the general principles of diseases/infection prevention. 4.2 Explain the general principles of disease control. 4.3 Explain the general principles of chemotherapy 4.4 Explain the general principles of antibiotic therapy. 4.5 List the common antibiotics, their afflictions and modes of action. Give examples of other therapeutic agents, their applications and modes of action. 4.6 Explain susceptibility to antibiotics and the principles of susceptibility testing.	Lecture and explain using charts, diagrams	Chalkboard Charts

Week	General Objectives		
	Special Learning Objective	**Teachers Activities**	**Resources**
	4.7 Explain the factors affecting susceptibility to antibiotics and susceptibility testing in the laboratory. 4.8 Carry out antibiotic susceptibility tests in the laboratory. 4.9 Explain antibiotic resistance and factors responsible for it. 4.10 Obtain and examine infective simples of pathogens e.g. sputum, faeces, urine, skin swabsate. 4.11 Explain the term "Nosocomial Infections". 4.12 Explain the prevention and control of Nosocomial infections.	Carry out experiments to demonstrate varying degrees of susceptibility of organisms to different antibiotics. Obtain samples from infected persons (patient) an examine same.	

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-4	**1.2** Demonstrate virulence factors in pathogenic bacteria and fungi of plants, animals and man.	Demonstrate the examples of bacteria, viruses, fungi and protozoan with prepared slides.	Experimental animals
5-6	2.1 Identify bacteria, fungi, viruses and protozoan	Demonstrate the examples of bacteria, viruses, fungi and protozoan with prepared slides.	Microscopes Prepared slide charts, manual colored atlas.
	4.13 Carry out antibiotic susceptibility tests in the laboratory.	Carry out experiments to demonstrate varying degrees of susceptibility of organisms to different antibiotics	Experimental animal

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **IMMUNOLOGY AND PUBLIC HEALTH**

CODE: **STM 415**

DURATION: **(Hour/Week)** Lecture: 1 Tutorial: 0 Practical: 3

UNIT: **2.0**

GOAL: This course is designed to provide the student with a knowledge of the principles and practice of immunology and public health and the impact they have on the community.
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GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the nature of the immune system.
2.0 Understand Antigen – Antibody and Allergic Reactions.
3.0 Understand complement fixation tests.
4.0 Know the Nature of Toxins and Antitoxins.
5.0 Know the significance of immunology in Public Health.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: IMMUNOLOGY AND PUBLIC HEALTH		**Course Code: STM 415**	**Contact Hours: 1 – 0 - 3**
Week	**General Objectives: 1.0 Understand the nature of the Immune system**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 3	IMMUNOLOGY AND PUBLIC HEALTH 1.1 Explain the concept of immunology and public health. 1.2 Explain the terms "antigen" and other components of the immune system. 1.3 Explain the structure and synthesis of antibodies including monoclonal antibodies. 1.4 Explain the terms "natural" and "artificial" immunity.	Lectures	Blackboard Charts Video Projetors

Week	General Objectives: 2.0 Understand Antigen – Antibody and Allergic Reactions		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 6	ANTIGEN /ANTIBODY AND ALLERGIC REACTION 2.1 Explain the various antigen-antibody reactions. 2.2 Explain the various types of hypersensitivity (delayed, immediate etc), and allergic reactions. 2.3 Describe the factors affecting antigen-antibody reactions. 2.4 Explain the ABO blood grouping (Blood and Serum). 2.5 Explain the rhesus factor and incompatibilities in blood and rhesus. 2.6 Demonstrate some of the reactions in 2.1 above (e.g. agglutination, precipitation etc).	Lecture Demonstrate antigen-antibody reactions e.g. agglutination, precipitation coagulation.	Antisera Experimental animals Pipettes Micro titrer plates Pasteur pipettes

Week	**General Objectives: 3.0 Understand complement fixation tests**		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 8	COMPLEMENT FIXATION TESTS 3.1 Explain the term “complement” 3.2 Prepare and standardize complement. 3.3 Prepare and standardize haemolysm. 3.4 Prepare an indicator system. 3.5 Carry out complement fixation tests proper.	Lecture Demonstrate preparation and standardization of complement, haemolysin and indicator system. Demonstrate complement fixation	Immunofluorescence microscope UV lamps Inoculating hood

Week	General Objectives: 4.0 Know the Nature of Toxins and Antitoxins		
	Special Learning Objective	**Teachers Activities**	**Resources**
9 - 11	TOXINS AND ANTITOXINS 4.1 Explain the terms "Toxins" (exo and endo toxins) and "Antitoxins". 4.2 Differentiate between exo and endo toxins. 4.3 Prepare an antitoxin. 4.4 Test the antitoxin prepared in 4.3 above for potency. 4.5 Describe the preparation of toxoids. 4.6 Describe the preparation and standardization of vaccines. 4.7 Describe the various methods of immunization.	Demonstrate the preparation of antitoxin Test the antitoxin for potency	

Week	**General Objectives: 5.0 Know the significance of immunology in Public Health**		
	Special Learning Objective	**Teachers Activities**	**Resources**
12 - 14	IMMUNOLOGY IN PUBLIC HEALTH 5.1 Explain the mechanisms of resistance to infection. 5.2 Explain the relationship between infection and immunity. 5.3 Explain the interaction of drugs in the immune system. 5.4 List the common communicable diseases in Nigeria e.g. cholera, AIDS, typhoid etc. 5.5 Explain the immune measures against the infections in 5.4 above. 5.6 Distinguish between “endemic”, “pandemic” and “epidemic” diseases. 5.7 Explain the prevention and control methods applicable teach of the situations in 5.6 above.	Lecture and give assignments	Blackboard Charts

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
4-6	2.6 Demonstrate some antigen – antibody and hypersensitivity reactions	Demonstrate antigen-antibody reactions e.g. agglutination, precipitation coagulation	Antisera Experimental animals Pipettes Micro titrer plates Pasteur pipettes
7-8	3.5 Carry out complement fixation tests proper	Demonstrate preparation and standardization of complement, haemolysin and indicator system. Demonstrate complement fixation	Immunofluorescence microscope
9-11	4.4 Prepare an antitioxin 4.4 Test the antitoxin prepared in 4.3 above for potency	Demonstrate the preparation of antitoxin Test the antitoxin for potency	Experimental plants and animals

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **MICROBIOLOGICAL QUALITY CONTROL**

CODE: **STM 421**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 4

UNIT: **4.0**

GOAL: This course is designed to provide the student with a knowledge of the principles and practice of Microbiological quality control.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the significance and the conduct of routine microbiological tests in quality control.
2.0 Know the types of microorganisms in water and the methods of assessing the microbiological quality of water.
3.0 Know the type of microbes in food and food products and the methods for assessing the microbiological quality of foods.
4.0 Understand the microbiological examination of alcoholic and non-alcoholic beverages.
5.0 Know the types of microorganisms involved in the contamination and spoilage of pharmaceuticals and the methods of assessing the quality of these products.
6.0 Know the types of microbes involved in the contamination and spoilage of biological (vaccines, era, infusion fluid etc) and the methods of assessing the quality of these products.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: MICROBIOLOGICAL QUALITY CONTROL		**Course Code: STM 421**	**Contact Hours: 2 – 0 - 4**
Week	**General Objectives: 1.0 Understand the significance and the conduct of routine microbiological tests in quality control**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 2	MICROBIAL QUALITY CONTROL 1.1 Explain the objectives of microbiological quality control. 1.2 Describe the set-up of a microbiological laboratory for quality control. 1.3 Explain the methods for sampling, sample preparation and handling for microbiological test for the following: (a) food and food products (b) water (c) pharmaceutical products (d) biological (sera, vaccines infusion, media etc) (e) alcohol and alcoholic beverages 1.4 Explain the general methods used in inoculation and incubation of materials 1.5 Carry out the following quantitative and qualitative microbiological tests (a) microscopic slide examination for total microorganisms (bacterial, fungal and protozoan counts) (b) dye reduction tests for viable microorganisms (c) most probable number technique for viable microorganisms (d) standard plate count for microorganisms	Lectures Demonstrate different microbiological technique	Microscopes Centrifuge Colony counter Refrigerator Analytical balance Incubator Oven Dryers Autoclave Kilteration units Distiller De-ionizer pH meter Spectrophotometer AAS Turbidimeter Colorimeter Automatic voltage stabilizer (AVS) Anaerobic jars Anaerobic gas-packs Slide projectors

Week	General Objectives: 2.0 Know the types of microorganisms in water and the methods of assessing the microbiological quality of water		
	Special Learning Objective	**Teachers Activities**	**Resources**
3 - 4	MICROBIOLOGICAL QUALITY OF WATER 2.1 List the different microorganisms (according to types) normally found in water. 2.2 Explain the sources and the nature of survival of the different microorganisms listed in 2.1 above. 2.3 Explain the concept of indicator organisms in the determination of microbial quality of water. 2.4 Explain the significances of the organisms listed in 2.1 above. 2.5 Explain the use of coliforms (E. coli) and faecal streptococci (strep. faecals) as indicators of water quality. 2.6 Carry out the following tests: (a) presumptive coliform test (b) confirmed coliform test (c) completed coliform test 2.7 Describe the serial dilution of liquid samples and carry out the procedure. 2.8 Estimate the number of coliforms in a sample of water by the most probable-number (MPN) technique. 2.9 Estimate the numbers of coliforms (or other bacteria) in a sample of water by means of the membrane filter(MF) technique.	As above Carry out MPN tests Carry out other e.g. membrane filter test to count coliform Carry out tests to count different indicator populations	As in 1.0 above

Week	General Objectives: 3.0 Know the type of microbes in food and food products and the methods for assessing the microbiological quality of foods		
	Special Learning Objective	**Teachers Activities**	**Resources**
5 - 8	MICROBIOLOGICAL QUALITY OF FOODS 3.1 List all microorganisms found in the following foods and food products: (a) meat and meat products (b) milk and milk products (c) fruits and vegetables (d) fish and other sea foods (e) baked food and confectionary 3.2 Explain the sources and nature of survival of the different organisms listed in 3.1 above. 3.3 List the factors that affect the chances of and degree of contamination of the food and food products listed in 3.1 above. 3.4 Carry out the following test on food and food products: (a) physical examination of canned food and determination of gas formers in canned foods (b) salmonella test (c) staphylococcus test (using baird-parker's medium) (d) methylene blue test, resazuru, dye reduction and phosphates tests (e) Rot-honward mould count (f) Diacetyl-value especially for citrus fruits (g) Counts of salt-tolerant organisms using Bair-parker or high salt containing media (h) Examination for <u>clostridium</u> <u>perfringes</u>	Lectures Carry out tests to demonstrate food spoilage Carry out tests to demonstrate salmonella, staphylococcus Demonstrate the use of methylene blue test and carry tests Carry out Rot-honward mould count Determine diacetyl-value of citruses Count salt tolerant organisms on appropriate media	Refrigerator Deep freezer Stomacher Warring blenders Water baths Sterilizers (potable)

Week	General Objectives:		
	3.5 Describe the microbial examination of the following: (a) compressed baker's yeast (b) stored cereal grains (c) flour 3.6 Examine bread and other confectionaries for microbial contamination by the yeast count method.	Carry out examination of confectionaries and bakeries	As in 1.0 above

Week	General Objectives: 4.0 Understand the microbiological examination of alcoholic and non-alcoholic beverages		
	Special Learning Objective	**Teachers Activities**	**Resources**
9 - 10	MICROBIOLOGICAL QUALITY OF ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES 4.1 Differentiate between alcoholic and non-alcoholic beverages giving examples of each. 4.2 List the microorganisms involved in the production of alcoholic beverages. 4.3 List the microorganisms that can contaminate and or spoil alcoholic and non-alcoholic beverages and their sources. 4.4 Describe how the organisms listed in 4.3 above affect the quality of alcoholic and non-alcoholic beverages.	- do - As above	As in 1.0 above

Week	General Objectives:		
	4.5 Carry out the following microbiological tests on beverages (a) detection of wild yeasts (b) plate count (c) multiple tube count method 4.6 Explain the methods of preventing contamination of beverages.	Carry out experiments to demonstrate objection 4.5	

Week	General Objectives: 5.0 Know the types of microorganisms involved in the contamination and spoilage of pharmaceuticals and the methods of assessing the quality of these products		
	Special Learning Objective	**Teachers Activities**	**Resources**
11 - 12	MICROBIAL SPOILAGE OF PHARMACEUTICALS 5.1 List the contaminating and spoilage organisms associated with pharmaceutical products and their sources. 5.2 Carry out the following microbiological tests on pharmaceutical products. (a) plate count (for bacteria and fungi) (b) wet mount (for identification of protozoan) 5.3 Carry out purity and sterility tests on the products in 5.2 above.	As above Carry out experiments to demonstrate 5.2	As in 1.0 above

Week	General Objectives: 6.0 Know the types of microbes involved in the contamination and spoilage of biological (vaccines, sera, infusion fluid etc) and the methods of assessing the quality of these products		
	Special Learning Objective	**Teachers Activities**	**Resources**
13 - 14	6.1 List the microorganisms likely to contaminate and spoil biological (vaccines, sera, media, infusions etc) and their sources. 6.2 Explain how contamination by the organism listed in 6.1 can lead to spoilage. 6.3 Describe how the contamination/spoilage of biological can be detected (e.g. turbidity, flocculation, precipitation, colour change etc). 6.4 Carry out the following microbiological quality tests: (a) microscopic examination (b) viable counts (plate count) (c) sterility and purity tests (d) wet mount (e) anaerobic cultivation (for anaerobics) 6.5 Describe filtration as a method of purifying contaminated biologicals.	As above Carry out experiments to demonstrate 6.4 in objectives4.5	As in 1.0 above

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
1-2	1.5 Carry out the following quantitative and qualitative microbiological tests (e) microscopic slide examination for total microorganisms (bacterial, fungal and protozoan counts) (f) dye reduction tests for viable microorganisms (g) most probable number technique for viable microorganisms (h) standard plate count for microorganisms	Demonstrate different microbiological technique	Microscopes Centrifuge Colony counter Refrigerator Analytical balance Incubator Oven Dryers Autoclave Kilteration units Distiller De-ionizer pH meter Spectrophotometer AAS Turbidimeter Colorimeter Automatic voltage stabilizer (AVS) Anaerobic jars Anaerobic gas-packs Slide projectors
3-4	2.7 Carry out the following tests: (d) presumptive coliform test (e) confirmed coliform test (f) completed coliform test	Carry out MPN tests Carry out other e.g. membrane filter test to count coliform Carry out tests to count different indicator populations	

5-8	3.7 Carry out the following test on food and food products: (a) physical examination of canned food and determination of gas formers in canned foods (b) salmonella test © staphylococcus test (using baird-parker's medium) (d) methylene blue test, resazuru, dye reduction and phosphates tests (e) Rot-honward mould count (f) Diacetyl-value especially for citrus fruits (g) Counts of salt-tolerant organisms using Bair-parker or high salt containing media (h) Examination for clostridium perfringes	Carry out tests to demonstrate food spoilage Carry out tests to demonstrate salmonella, staphylococcus Demonstrate the use of methylene blue test and carry tests Carry out Rot-honward mould count Determine diacetyl-value of citruses Count salt tolerant organisms on appropriate media	Refrigerator Deep freezer Stomacher Warring blenders Water baths Sterilizers (potable)
9-10	4.5 Carry out the following microbiological tests on beverages (i) detection of wild yeasts (j) plate count (k) multiple tube count method	Carry out experiments to demonstrate objection 4.5	
11-12	5.2 Carry out the following microbiological tests on pharmaceutical products. (c) plate count (for bacteria and fungi) (d) wet mount (for identification of protozoan) 5.3 Carry out purity and sterility tests on the products in 5.2 above	Carry out experiments to demonstrate 5.2	

13-14	6.4 Carry out the following microbiological quality tests: (f) microscopic examination (g) viable counts (plate count) (h) sterility and purity tests (i) wet mount (j) anaerobic cultivation (for anaerobics)	Carry out experiments to demonstrate 6.4 in objectives4.5	

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **IMMUNOLOGY AND PUBLIC HEALTH**

CODE: **STM 422**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 4

UNIT: **3.0**

GOAL: This course is designed to provide the student with a knowledge of general principles and technology of industrial utilization of microbes.

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Understand the nature and principles of industrial microbiology.
2.0 Understand the principles of microbial fermentation processes.
3.0 Understand the methods of cultivating industrial microorganisms.
4.0 Understand the technology of fermented alcoholic beverages.
5.0 Understand the technology of fermented distilled alcoholic beverages (spirit).
6.0 Understand the technology of fermented foods other than fermented alcoholic beverages.
7.0 Understand the technology of antibiotics production by fermentation.
8.0 Understand the technology of amino acid production by fermentation.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: INDUSTRIAL MICROBIOLOGY		**Course Code: STM 422**	**Contact Hours: 2 – 0 - 4**
Week	**General Objectives: 1.0 Understand the nature and principles of industrial microbiology**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1	SCOPE OF INDUSTRIAL MICROBIOLOGY 1.1 Outline the scope of industrial microbiology. 1.2 List all microorganisms of industrial importance. 1.3 Describe the general characteristics of microorganisms employed in industrial processes. 1.4 Identify all media used for industrial cultivation of microorganisms. 1.5 Identify the factors to be considered in choosing raw materials as nutrients for industrial microorganisms.	Lectures Assignments Questions and answer session Media identification	Blackboard Overhead projector Slide/projector Culture media

Week	General Objectives: 2.0 Understand the principles of microbial fermentation pocesses		
	Special Learning Objective	**Teachers Activities**	**Resources**
2 - 5	CHARACTERISTICS OF MICROBIAL FERMENTATION 2.1 Describe the morphology of bakers or brewers yeast as seen under the light microscope. **2.2** Describe the reproductio of a typical yeast cell **<u>Saccharomyces</u> cerevisiae.** 2.3 Explain mutation in yeasts. 2.4 Define the term fermentation. 2.5 Describe a simplified yeast fermentation cycle. 2.6 Explain the following regulatory effects on fermentation (a) Pasteur effect; (b) crabtree effect; (c) cluster effect; (d) negative Pasteur effect. 2.7 Describe the various ways of culturing yeasts in the laboratory. 2.8 Isolate pure yeast cultures in the laboratory. 2.9 Preserve pure yeast cultures in the laboratory. 2.10 Differentiate baker's yeast from wine yeast. 2.11 Describe the process of manufacturing bakers yeast. 2.12 Produce bakers yeast in the laboratory using molasses and fermenter.	Lectures Assignment Demonstrations Practical Question/answer session Culture yeast cell, grow and harvest yeast cells. Wash yeast cells Determine yeast productivity	Microscopes Glass ware Bench scale fermenter Pilot fermenter Rotary shaker Orbital shakers Centrifuge Vacuum pump Filters Wash bath Lyophilizes Refrigerators Freezers pH meters redox meter D/O meters Chemo stat Peristaltic pumps Tubes/connectors Incubators jars Steam generators Gas tanks Gas chromatograph Liquid chromatograph Phase contrast microscope

Week	General Objectives:		
	Special Learning Objective	**Teachers Activities**	**Resources**
	2.13 Differentiate between top and bottom fermenting brewer's yeast. 2.14 Explain the role of the following microorganisms in food processing and preservation: (a) lactic acid; (b) acetic acid bacteria 2.15 Describe the principles of acetic and lactic acid fermentations. 2.16 List and explain the factors that affect fermentation processes; substrate pH; O/R potential, temperature. 2.17 Carry out the fermentation process varying such factors as period of fermentation etc.		

Week	General Objectives: 3.0 Understand the methods of cultivating industrial microorganisms		
	Special Learning Objective	**Teachers Activities**	**Resources**
6 - 7	CULTIVATING INDUSTRIAL MICROORGANISMS 3.1 Distinguish between continuous cultivation and bath cultivation. 3.2 Sketch a simplified diagram of continuous culture process. 3.3 List the requirements and characteristics of continuous culture systems. 3.4 Explain the mathematical theory of continuous cultivation. 3.5 Describe the techniques of continuous culture and the advantages and disadvantages of the system. 3.6 Explain the principles and techniques of batch cultivation of microorganisms. 3.7 Explain the mathematical theory of growth in batch culture.	- do –	- do –

Week	General Objectives: 4.0 Understand the technology of fermented alcoholic beverages		
	Special Learning Objective	**Teachers Activities**	**Resources**
8 - 9	FERMENETED ALCOHOLIC BEVERAGES 4.1 Define alcoholic beverages and differentiate from non-alcoholic beverages. 4.2 List the various alcoholic beverages and their basic raw materials. 4.3 Explain the influence of raw materials on the quality and characteristics of alcoholic beverages. 4.4 Describe the microbial processes involved in alcoholic based industries. 4.5 Describe the technology of beer brewing. 4.6 Describe the technology of wine manufacture. 4.7 Describe the defects that may occur in beer and wines as a result of undesirable microbial action. 4.8 Produce and compare wines from various local fruits e.g. banana, citruses etc. 4.9 Produce and compare alcoholic beverages from various cereals. 4.10 Bottle and preserve palm wine.	Lectures Practical Demonstrations Assignment Questions and answer session Carry out laboratory scale production of wines using local fruits Produce alcoholic beverages from different cereals Carry out the bottling of palm wine	Microscopes Centrifuge Refrigerator Balances Shakers/Incubator Hot air oven Freeze dryers Autoclave Refractometer Blender Water bath Hot plate Magnetic stirrers Thermometers Filters (various) - Ball mills - Roller mills - Graded mills pH meter Spectrophotometer

Week	**General Objectives: 5.0 Understand the technology of fermented distilled alcoholic beverages (spirit)**		
	Special Learning Objective	**Teachers Activities**	**Resources**
10	FERMENTED DISTILLED ALCOHOLIC BEVERAGES 5.1 Define spirits. 5.2 Differentiate spirit from other fermented alcoholic beverages. 5.3 Describe the process of whiskey manufacture. 5.4 Explain the basic differences between gin, brandy, rum, cordials/liquors, vodka and whiskey. 5.5 Distill palm wine to obtain alcohol. 5.6 Produce distilled alcohol from various local cereal.	Carry out the distillation of palm wine Determine the amount and purity of alcohol produced per volume of palm wine Estimate alcohol content of palm wine	Distillation units Centrifuge Fermenters Malting chambers Incubator Oven Rotary shakers Autoclave Roller mills Bunsen burner Graded sieves pH meter Spectrophotometer Colorimeter Cold incubators Ball mills

Week	General Objectives: 6.0 Understand the technology of fermented foods other than fermented alcoholic beverages		
	Special Learning Objective	**Teachers Activities**	**Resources**
11 - 12	OTHER FERMENTED FOODS 6.1 Describe the microbial fermentation of indigenous roots and tubers e.g. cassava to produce garri. 6.2 Describe the microbial fermentation of indigenous cereals to produce "Ogi/Akamu". 6.3 Describe the microbial fermentation of indigenous legumes and oil seeds e.g. African locust bean to produce "Iru/Dawadawa/Ogiri". 6.4 Describe the microbial fermentation of other plants and animal materials that are locally available to obtain products of food value. 6.5 Produce Ogi/Akamu, Dawadawa/ogiri and other fermented native foods. 6.6 Describe ways by which the foods in 6.5 above can be enriched.	- do – Carry out laboratory producton of Akamu Carry out fermentation to different levels and compare the sensory qualities of the akamu produced Produce dawadawa and ogiri in the laboratory	Glass ware Freezers Refrigerator Incubator pH meter Gas chromotograph High pressure Liquid chromatograph Mass specrometer Oxygen analyzer Carbon dioxide analyzer

Week	General Objectives: 7.0 Understand the technology of antibiotics production by fermentation		
	Special Learning Objective	**Teachers Activities**	**Resources**
13	ANTIBIOTICS PRODUCTION 7.1 List medically important antibiotic. 7.2 Describe the microorganisms responsible for the production of antibiotics listed in 7.1 above. 7.3 Describe the processes involved in the production of (a) penicillin (b) streptomycin (c) bactracin 7.4 Describe methods and equipment used for harvesting/purifications of antibiotics named in 7.3 above.	- do –	Centrifuge pH meter Fermenters Filters Vacuum pumps Blackboard

Week	General Objectives: 8.0 Understand the technology of amino acid production by fermentation		
	Special Learning Objective	**Teachers Activities**	**Resources**
14	AMINO ACID PRODUCTION 8.1 List industrially important amino acids. 8.2 Describe the microorganisms responsible for the production of commercially important amino acids. 8.3 Describe the processes involved in the production of Glutamic acid (monosodium glutamate seasoning agent) 8.4 Describe methods and equipment needed for harvesting/purifications of amino acids in 8.3 above.	- do –	- do –

	PRACTICAL CONTENT		
Week	**Special Learning Objective**	**Teachers Activities**	**Resources**
2-5	2.8 Isolate pure yeast cultures in the laboratory. 2.9 Preserve pure yeast cultures in the laboratory. 2.10 Differentiate baker's yeast from wine yeast. 2.11 Describe the process of manufacturing bakers yeast. 2.12 Produce bakers yeast in the laboratory using molasses and fermenter. 2.17 Carry out the fermentation process varying such factors as period of fermentation etc.	Culture yeast cell, grow and harvest yeast cells. Wash yeast cells Determine yeast productivity	Microscopes Glass ware Bench scale fermenter Pilot fermenter Rotary shaker Orbital shakers Centrifuge Vacuum pump Filters Wash bath Lyophilizes Refrigerators Freezers pH meters redox meter D/O meters Chemo stat Peristaltic pumps Tubes/connectors Incubators jars Steam generators Gas tanks Gas chromatograph Liquid chromatograph Phase contrast microscope

8-9	4.8 Produce and compare wines from various local fruits e.g. banana, citruses etc. 4.9 Produce and compare alcoholic beverages from various cereals. 4.10 Bottle and preserve palm wine.	Carry out laboratory scale production of wines using local fruits Produce alcoholic beverages from different cereals Carry out the bottling of palm wine	Microscopes Centrifuge Refrigerator Balances Shakers/Incubator Hot air oven Freeze dryers Autoclave Refractometer Blender Water bath Hot plate Magnetic stirrers Thermometers Filters (various) - Ball mills - Roller mills - Graded mills pH meter Spectrophotometer

10	5.5 Distill palm wine to obtain alcohol. 5.6 Produce distilled alcohol from various local cereal.	Carry out the distillation of palm wine Determine the amount and purity of alcohol produced per volume of palm wine Estimate alcohol content of palm wine	Distillation units Centrifuge Fermenters Malting chambers Incubator Oven Rotary shakers Autoclave Roller mills Bunsen burner Graded sieves pH meter Spectrophotometer Colorimeter Cold incubators Ball mills
11-12	6.5 Produce Ogi/Akamu, Dawadawa/ogiri and other fermented native foods.	Carry out laboratory producton of Akamu Carry out fermentation to different levels and compare the sensory qualities of the akamu produced Produce dawadawa and ogiri in the laboratory	Glass ware Freezers Refrigerator Incubator pH meter Gas chromotograph High pressure Liquid chromatograph Mass specrometer Oxygen analyzer Carbon dioxide analyzer

PROGRAMME: **SCIENCE LABORATORY TECHNOLOGY - MICROBIOLOGY**

COURSE: **WASTE TREATMENT OF UTILIZATION**

CODE: **STM 423**

DURATION: **(Hour/Week)** Lecture: 2 Tutorial: 0 Practical: 2

UNIT: **3.0**

GOAL: This course is designed to provide the student with a knowledge of the

GENERAL OBJECTIVES: On completion of this course the student should be able to:

1.0 Know the various wastes of food, allied and other industries and methods of their disposal.
2.0 Understand various methods of non-biological effluent waste treatment.
3.0 Understand various methods of biological waste treatment, recycling and reuse.
4.0 Understand various methods of air pollution control.
5.0 Introduction to the principles of Environmental Impact Assessment.

Programme: SCIENCE LABORATORY TECHNOLOGY: MICROBIOLOGY			
Course: WASTE TREATMENT AND UTILIZATION		**Course Code: STM 423**	**Contact Hours: 2 – 0 - 2**
Week	**General Objectives: 1.0 Know the various wastes of food, allied and other industries and methods of their disposal**		
	Special Learning Objective	**Teachers Activities**	**Resources**
1 - 3	TYPES OF WASTE 1.1 Identify sources of various wastes. 1.2 Explain the nature of waste from 1.1 above. 1.3 Classify wastes into solid wastes, liquid wastes and wastewater. 1.4 Classify different solid wastes. 1.5 Describe the effect of the various wastes on the environment. 1.6 List various methods of solid waste treatment and disposal. 1.7 List various methods of liquid waste treatment and disposal. 1.8 List and describe various methods of waste reclamation and recycling. 1.9 Explain the uses of reclaimed/recycled wastes as fuel, fertilizer, animal feed, feed supplement, feed stock and irrigation.	Lectures Demonstration Film shoos Assignments Visit/excursion	Blackboard Overhead projectors and slides Television and video equipment

Week	General Objectives: 2.0 Understand various methods of non-biological effluent waste treatment		
	Special Learning Objective	**Teachers Activities**	**Resources**
4 - 6	EFFLUENT WASTE TREATMENT 2.1 List different types of insoluble / solid wastes and describe their effects on the environment and ecosystem. 2.2 Estimate total organic matter waste and wastewater. 2.3 Define Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Oxygen Carbon (TOC). 2.4 Explain methods of determining BOD, COD and TOC of wastes. 2.5 List the possible chemical and biochemical toxic substances in effluents from food and other allied industries. 2.6 Explain the principles of physical treatment of wastewater under the following: flocculation, sedimentation, centrifugation, floatation, adsorption, filtration, ultra filtration, and reverse osmosis, electro dialysis. 2.7 Explain the principles of chemical treatment of wastewater under the following methods: coagulation, emulsion breaking, neutralization, precipitation, chemical oxidation (using ozone, hydrogen peroxide, chlorine etc). 2.8 Explain the advantages and limitations of each of the processes studied in 2.6 and 2.7 above. 2.9 Explain other physical and chemical methods for treating solid wastes e.g. incineration.	Lectures Carry out BOD, COD and TOC tests Excursion to treatment plants Video films Assignments Questions Demonstration	Blackboard Projectors Video equipment BOD bottles COD digesters Spectrophotometer Colorimeter Ovens Seitz filtration equipment Hot plate Freeze dryers Membrane filters Blenders Microwave ovens Centrifuge Incubators Soxhlet equipment Furnaces Sintered glass filters Autoclave Kjedahl apparatus Micro incinerators

Week	General Objectives: 3.0 Understand various methods of biological waste treatment, recycling and reuse		
	Special Learning Objective	**Teachers Activities**	**Resources**
7 - 10	BIOLOGICAL WASTE TREATMENT, RECYCLING AND REUSE 3.1 Explain the principles of biological treatment of solid wastes and wastewater. 3.2 Describe the technology and operation of different aerobic biological wastewater treatment processes: (a) activated sludge (b) aerated lagoon (c) stabilization ponds (d) trickling filters (e) oxidation ditches 3.3 Describe the technology and operation of different anaerobic biological wastewater treatment processes e.g. anaerobic ponds and sludge blankets. 3.4 Describe the technology and operation of different biological solid waste treatment processes: (a) composing (b) thermophilic digestion 3.5 Dsecribe the technology and operation of different modern waste treament processes: (a) nitrogen stripping (b) phosphate stripping (c) desalination (d) dual cycle / combine processes (e) pyrolyses, etc	Lectures Assignment Questions and answer sessions Demonstration Excursion / visit to sewage treatment plants	Blackboard Projectors Video equipment

Week	General Objectives:		
	3.6 Describe how the methods described in 3.2 – 3.4 above are used to reprocess/recycle waste products. 3.7 Explain the principles of waste recycling and reutilization. 3.8 List and describe various methods of waste reutilization including production of biomass, single cell protein, protein-enriched waste etc. 3.9 Describe the use of the methods in 3.2 – 3.4 to degrade toxic, noxious compounds and xenobiotics.	- do -	- do -

Week	General Objectives: 4.0 Understand various methods of air pollution control		
	Special Learning Objective	**Teachers Activities**	**Resources**
11 - 12	4.1 List different types of air pollutants. 4.2 List the various sources of air pollution e.g. gas flare, exhaust fumes, etc. 4.3 Describe the effects of air pollution on the environment e.g. acid rain, smog etc. 4.4 List possible chemical and biochemical toxic substances in air pollutants. 4.5 Explain the principles and methods of control of air pollution using particulate and noxious gas removed.	- do –	Air samples O_2 analyser CO_2 analysre Atomic absorption spectrophotometer Mass spectrophotometer

Week	**General Objectives: 5.0 Introduction to the principles of Environmental Impact Assessment**		
	Special Learning Objective	**Teachers Activities**	**Resources**
13-14	ENVIRONMENTAL IMPACT ASSESSMENT 5.1 Explain the basic principles of environmental impact assessment. 5.2 Describe the basic procedures for achieving environmental impact assessment (in a given risk environment) 5.3 Describe the basic procedure for preparing impact assessment statements/reports. 5.4 Explain the preparation of environment audit report.	Lectures Assignment Class round table discussion Visit to sites to carry out impact studies	Projects Blackboards

SCIENCE LABORATORY TECHNOLOGY
HIGHER NATIONAL DIPLOMA BIOLOGICAL SCIENCES OPTIONS

MINIMUM LIST OF EQUIPMENT

1. BIOLOGY LABORATORY

See list of equipment for Biology Laboratory ND SLT

Additional List of Equipment required are:-

S/No	Description	Quantity	Remarks
1.	Chromatographic equipment	4	
2.	Extraction equipment – Sohxlet etc	4	

2. MICROBIOLOGY LABORATORY

S/No	Description	Quantity	Remarks
1.	Autoclave (for preparatory and media room	2	
2.	Portable autoclave preparatoryand media room	4	
3.	Steamers	2	
4.	Dryer (Big)	2	
5.	Hot air oven	2	
6.	Distillation apparatus	2	
7.	Blender	4	
8.	Top loading balance	5	
9.	Analytical balance	2	

10.	Incubators	2	
11.	Centrifuges (manual)	2	
12.	Centrifuges (Electrical)	2	
13.	Water bath (thermostatically controlled)	3	
14.	Shaker/incubator	2	
15.	Anaerobic ars	5	
16.	Innoculating hood	1	
17.	Magnetic stirrer	2	
18.	Hot plate	2	
19.	Colony counter (electrically controlled)	2	
20.	Manual colony counter	10	
21.	Air sampler	2	
22.	Hand lenses	30	
23.	Lovibond colour comparator	5	
24.	PH meters	2	
25.	Seitz filteration apparatus	1	
26.	Seitz filters	(Various sizes)	
27.	Membrane filteration apparatus	1	
28.	Candle filteration unit	2	
29.	Spectrophotometer	2	
30.	Membrane filter	3 pkts	
31.	Colorimeters	2	
32.	Viscometers	2	
33.	Freeze dryer	1 (optional)	
34.	Thermometers various ranges	10 each	
35.	Vacuum pump	2	
36.	Blood grouping kits	2	
37.	Scapel holders	10	
38.	Forceps	10	

MICROSCOPES

S/No	Description	Quantity	Remarks
39.	Binoculars	30	
40.	Monoculars	1	
41.	Flourescent	1	
42.	Dark field	1	
43.	Phase Contrast	1	
44.	Projection microscope		

3. INSTRUMENTATION ROOOM

S/No	Description	Quantity	Remarks
1.	Measuring instruments:		
	Moving coil	2	
	Moving iron	2	
	Thermocouple	2	
	Oscilloscope	2	
	Signal generators	2	
	Pressure Measuring Instrument Barometers	2	
	Manometers	2	
	Pressure gauges	2	
2.	Spectrophotometer	1 each	
3.	Colorimeter	1	
4.	Flame photometer	1	
5.	Raman spectrophotometer	1	
6.	Atomic absorption spectrophotometer	1	
7.	X-ray spectroscope	1	
8.	Electrolytic conductivity bridge	1	

9.	Coulometric titrator	1	
10.	PH meter	1	
11.	Autotitrator	2	
12.	Polarotgraph	1	
13.	Radio active detector	1	
14.	Fluorimeter	1	
15.	Polarimeter	1	
16.	Refractometer	1	
17.	Autoradiograph	1	
18.	Camera Lucida	3	
19.	Voltameter	5	
20.	Ammeter	5	
21.	Resistors	2 each	
22.	Conductivity meter	1	
23.	Ion-selecture electrodes	2	
24.	Ion-exchange electrodes	2	
25.	Microscopes	10	
26.	Autodiography	1	
27.	Camera Lucida	1	
28.	Colony counter	3	
29.	Autoclave	2	
30.	Centrifuge	2	
31.	Inubator	2	
32.	Melting point apparatus	2	
33.	Gas/Liquid Chromatorgraphy	2	
34.	Liquid/Liquid Chromatography	2	
35.	Column Chromatography	2	
36.	Rotary Evaporator	2	

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