

NATIONAL BOARD FOR TECHNICAL EDUCATION

NATIONAL DIPLOMA

HIGHER NATIONAL DIPLOMA

IN

FOOD TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATION

2002.

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

NATIONAL DIPLOMA (ND) AND HIGHER NATIONAL DIPLOMA (HND) IN FOOD TECHNOLOGY

1. GENERAL INFORMATION

Goal and Objectives

NATIONAL DIPLOMA (ND)

i. Programme Goal

This programme is designed to produce food preservation and processing technicians capable of complementing the work of food scientists and engineers in the preservation of food commodities in the field and in the industry.

ii. Programme Objectives

A diplomate of the technical programme in food technology should be able to:

- a. assist in the chemical and biological analysis of raw and processed food:
- b. store agricultural produce for industrial use:
- c. assist in all types of industrial food processing and packaging:
- d. market all types of processed and preserved food and food processing and preservation chemicals and equipment.

iii. Entry Requirements

- (a) The minimum entry requirement into the National Diploma in Food Technology is four credit level passes in the West African School Certificate, General Certificate of Education (GCE), Ordinary level or Senior Secondary School Certificate in not more than two sittings.

The subjects must include the following:-

Chemistry, Biology/Agricultural Science and Mathematics and one of the following:-

Physics, Economics, Food and Nutrition, Geography plus minimum of passes in Physics and English Language.

- (b) Candidates who have successfully completed the Board's recognized Pre-National Diploma (Science and Technology) course may be admitted into the programme. Such students must have pass grades in Agricultural

Science, Biology, Chemistry, Mathematics and one other subject chosen from Physics, Economics, Food and Nutrition, Geography in WASC or GCE 'O' level before undertaking the course.

HIGHER NATIONAL DIPLOMA

iv. **Programme Goal:**

This programme is designed to produce food technologist who will be able to carry out preservation and processing of food commodities in the field and in the industry.

v. **Programme Objectives:**

A diplomates of this programme should be able to:

- . Carry out biological and chemical analysis of raw and processed food
 - . Carry out all types of industrial food processing and packaging.
 - . Store agricultural produce for industrial use.
 - . Carry out quality assessment of raw and processed good.
- Develop and manage food and other agro allied enterprises.

vi. **Entry Requirements**

The entry qualification into Higher National Diploma in Food Technology programme is at least a lower credit level pass in National Diploma in Food Technology obtained from an accredited Food Technology programme.

Candidates with good National Diploma in Agricultural Technology, Science Laboratory Technology, Chemical Engineering may be considered. Such candidates may be required to take additional courses.

Candidates are in addition required to have undergone at least one year relevant industrial experience.

2. STRUCTURE OF THE PROGRAMME

i. **NATIONAL DIPLOMA (ND)**

The National Diploma in Food Technology is a terminal programme and is structured to last for two years (four semesters). This incorporates three to four months of supervised industrial attachment at the end of the first year or the first two semesters of the programme.

ii. **HIGHER NATIONAL DIPLOMA**

The Higher National Diploma Food Technology programme is terminal and is structured to last for two years (four semesters).

3. CURRICULUM

i. **Curriculum** of all ND and HND programmes consists of four main components. These are:

- a. General Studies/Education
- b. Foundation Courses
- c. Professional Courses
- d. Student industrial work experience scheme (SIWES)

ii. **The General Education** component shall include courses in:

art and humanities – English language, communication, history. These are compulsory.
mathematics and science (for non-science based programmes)
social studies – citizenship (the Nigerian Constitution), political science, sociology, philosophy, geography, entrepreneurship, philosophy of science.

Physical and Health Education (one semester credit only)

The General Education component shall account for not more than 15% of total contact hours for the programme.

iii. **Foundation Courses** include courses in economics, mathematics, pure sciences, technical drawing, descriptive geometry, statistics, etc. The number of hours will vary with the programme and may account for about 10 – 15% of the total contact hours.

iv. **Professional Courses** are courses, which give the student the theory, and practical skills he needs to practice his field of calling at the technician/technologist level. These may account for between 60-7-% of the contact hours depending on programme.

- v. **Student Industrial Work Experience Scheme (SIWES)** shall be taken during the long vacation following the end of the second semester of the first year. See details of SIWES in Guideline on SIWES at page 5.

4. ACCREDITATION

Each programme offered at the ND or HND level shall be accredited by NBTE before the diplomats can be awarded either of the two diploma certificates. Details about the process of accrediting a programme for the award of the ND or HND are available from the Executive Secretary, Programmes Division, National Board for Technical Education, Plot B, Bida Road, P.M.B 2239, Kaduna, Nigeria.

5. CONDITIONS FOR THE AWARD OF THE ND/HND

- i. Institutions offering accredited programme will award the National Diploma to candidates who successfully completed the programme after passing prescribed coursework, examinations, diploma project and the supervised industrial work experience. Such candidates should have completed a minimum of between 72 and 80 semester credit units depending on the programme. Diplomas shall be classified as follows:

Distinction – GPA of 3.5 and above	Pass – GPA of 2.00 – 2.49
Upper Credit – GPA of 3.00 – 3.49	Fail – GPA of below 2.0
Lower Credit – GPA of 2.50 – 2.49	

- ii. **Evaluation of Award**

All terminal National Diploma and Higher National Diploma examinations must be externally node rated. In grading the award, the Board's Unified Grading System should be applied.

6. GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME

The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stresses the need to introduce the semester credit which will enable a student who so wishes to transfer units already completed in an institution to an institution of similar standard.

As the success of the credit unit system depends on the articulation of programme between the institutions and industry, the curriculum content has been written in behavioral objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomats of the programme. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of

the department teaching the programme to write their own curriculum stating the conditions existing in their institutions under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the Institution.

The aim is to continue to ensure that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programme offered through out the polytechnic system.

The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation of the theory. For each course, there should be a balance of theory to practice in the ratio of 50:50 or 60:40 or the reverse.

7. GUIDELINES ON SIWES PROGRAMME

For the smooth operation of the SIWES the following guidelines shall apply:

Responsible for Placement of Students.

- i. Institutions offering the ND programme, shall arrange to place the students in industry. By first semester of each course, six copies of the master list showing where each students has been placed shall be submitted to the executive secretary, NBTE which shall, in turn, authenticate the list and forward it to the Industrial training Fund, Jos.
- ii. The Placement Officer should discuss and agree with industry on the following:
 - a.) a task inventory of what the students should be expected to experience during the period of attachment.
 - b.) the industry – based supervisor of the students during the period likewise the institution based supervisor.
 - c.) The evaluation of the student during the period. It should be noted that the final grading of the student during the period of attachment should be weighted more on the evaluation by his industry-based supervisor.
- iii. In the evaluation of the student, cognizance should be taken of the following items;
 - a.) Punctuality
 - b.) Attendance
 - c.) General Attitude to Work
 - d.) Respect for Authority
 - e.) Interest in the Field/Technical area
 - f.) Technical competence as a potential technician in his field.

iv. Grading of SIWES

To ensure uniformity of grading scales, the institution should ensure that the uniform grading of students work which has been agreed to by all polytechnics is adopted.

v. **The Institution Base Supervisor**

The institution-based supervisor should initial the logbook during each visit. This will enable him to check and determine to what extent the objectives of the scheme are being met and to assist students having any problems regarding the specific assignments given to them by industry-based supervisor.

vi. **Frequency of Visit**

Institutions should ensure that students placed on attachment are visited within one month of their placement. Other visits shall be arranged so that

- 1) there is another visit six weeks after the first visits; and
- 2) a final visit in the last month of the attachment.

vii. **Stipend for Students in SIWES**

The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training Fund and the NBTE.

viii. **SIWES As a Component of the Curriculum**

The completion of SIWES is important in the final determination of whether the students is successful in the programme or not. Failure in the SIWES is an indication that the student has not shown sufficient interest in the field or has no potential to become a skilled technician in his field. The SIWES should be graded on a fail or pass basis. Where a student has satisfied all other requirements but failed SIWES, he may only be allowed to repeat another four months SIWES at his own expense.

**National Board for Technical Education,
Kaduna.
20 November 1989.**

NATIONAL DIPLOMA IN FOOD TECHNOLOGY
CURRICULUM TABLE
FIRST SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
STB 112	MORPHOLOGY AND PHYSIOLOGY OF LIVING ORGANISM	2	-	3	3	75	
STC 111	GENERAL PRINCIPLES OF CHEMISTRY	2	-	3	3	75	
BPH 111	MECHANICS AND PROPERTIES OF MATTER AND HEAT ENERGY	2	-	3	3	75	
PTD 111	TECHNICAL DRAWING	2		-	2	60	
FST 111	INTRODUCTION TO FOOD SCIENCE AND COMMODITIES	1		3	3	60	
COM 111	INTRODUCTION TO COMPUTING	2		2	3	60	
GNS 111	CITIZENSHIP EDUCATION I	2	-	-	2	30	
					19	435	

BCH BPH MTH PTD Syllabus for Basic Science & Mathematics
 GNS General Studies Syllabuses. STB STC Science laboratory technology
 COM Computer Science

NATIONAL DIPLOMA IN FOOD TECHNOLOGY
CURRICULUM TABLE
SECOND SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
BCH 121	ORGANIC AND INORGANIC CHEMISTRY	2	-	2	3	60	
BPH 121	OPTICS, WAVES, ELECTRICITY AND MAGNETISM	2	-	2	3	60	
MTH 111	LOGIC AND LINEAR ALGEBRA	2	-	-	2	30	
STB 211	INTRODUCTION TO MICROBIOLOGY	1	-	3	2	60	
NUD 122	HUMAN NUTRITION 1	2	-	-	2	30	
FST 121	FOOD CHEMISTRY	2	-	3	3	75	
FST 122	BASIC PRINCIPLES OF FOOD PROCESSING AND PRESERVATION	2	-	-	2	30	
COM 123	COMPUTER APPLICATION PACKAGES	2	-	2	3	60	
GNS 121	CITIZENSHIP EDUCATION II	2	-	-	2	30	
	SIWES – [3 – 4 months Industrial attachment Training with submission of a write up]		-	-			
					22	435	

NUD Nutrition and Dietetics ..

NATIONAL DIPLOMA IN FOOD TECHNOLOGY
CURRICULUM TABLE
THIRD SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
CME 122	BASIC WORKSHOP PRACTICE	2	-	-	2	60	
FST 211	FOOD BIOCHEMISTRY	1	-	-	1	15	
FST 212	FOOD ANALYSIS	2	-	3	2	75	
FST 213	FOOD PROCESS ENGINEERING	1	-	-	-	15	
FST 214	FOOD MICROBIOLOGY	1	-	3	2	60	
FST 215	BASIC HEAT TRANSFER AND FLUID MECHANICS	2	-	-	2	30	
FST216	PROCESSING AND PRESERVATION OF PLANT FOOD PRODUCTS	2	-	3	3	75	
GLT 111	MODULES 1 and 2	-	-	2	2	30	
COM 215	COMPUTER PARKAGES 11	2	-	2	2	60	
GNS 201	USE OF ENGLISH 11	2	-	-	2	30	
					18	450	

* See syllabus for Basic Science and Mathematics

+ see Syllabus for General Studies.

NATIONAL DIPLOMA IN FOOD TECHNOLOGY
CURRICULUM TABLE
FOURTH SEMESTER

Course Code	Course Title	L	T	P	CU	CH	Prerequisite
FST 221	FOOD QUALITY CONTROL[STATISTICS]	1	-	-	1	15	
FST 222	ENGINEERING MATERIALS IN FOOD SYSTEMS	1	-	1	2	30	
FST 223	INTRODUCTION TO FOOD PACKAGING	1	-	-	1	15	
FST 224	PROCESSING AND PRESERVATION OF ANIMAL	1	0	3	2	60	
FST 225	FOOD PRODUCTS	1	-	-	1	15	
FST 226	SEMINAR	-	-	-	4	-	
GLT 121	PROJECT	-	-	2	2	30	
COM 224	MODULES 3 and 4	2	0	1	2	45	
BAM 216	MANAGEMENT INFORMATION SYSTEM	2	0	0	2	30	
GNS 201	PRACTICE OF ENTREPRENEURSHIP	2	0	0	2	30	
	USE OF ENGLISH 11						
					19	270	

* See Syllabus for Basic Science and Mathematics

+ See syllabus for General studies.

** Please allow students to do some practicals oriented work i.e. those involving production, simple proximate analysis and sensory evaluation of product.

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: INTRODUCTION TO FOOD SCIENCE AND COMMODITIES
CODE: FST 111
DURATION: (Hours/Week) Lecture 1 Tutorial 0 Practical 5
UNITS: 4.0
GOAL: This course is designed to introduce the student to the state of Nigerian agriculture and commodities.

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

- 1.0 Acquire an introduction knowledge of rural agriculture in Nigeria
- 2.0 Know the role of government in National Food Security
- 3.0 Know the scope of food commodities
- 4.0 Know the scope of food commodities.
- 5.0 Understand the general principles of food packaging
- 6.0 Understand pre and post harvest factors affecting food production in the tropics
- 7.0 Understanding storage problems of locally produced food items
- 8.0 Understand the fundamental principles of traditional food processing and preservation in Nigeria.

PROGRAMME: FOOD TECHNOLOGY: NATIONAL DIPLOMA			
Course: INTRODUCTION TO FOOD SCIENCE AND COMMODITIES		Course Code: FST 111	Contact Hours: (1-0-3)
Course Goal: This course is designed to introduce the student to the state of Nigerian agriculture and commodities.			
WEEK	General Objectives ACQUIRE AN INTRODUCTORY KNOWLEDGE OF RURAL AGRICULTURE IN NIGERIA		
	Special Learning Objectives:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Acquire an introductory knowledge of rural agriculture in Nigeria.</p> <p>2.0 Role of Government in National Food Security.</p> <p>3.0 Outline of scope of food science and technology.</p> <p>4.0 Know the scope of food commodities.</p> <p>5.0 Understand the general principles of food production.</p> <p>6.0 Understand pre and post harvest factors affecting food production in the tropics.</p> <p>7.0 Understand storage problems of locally produced food items.</p> <p>8.0 Understand the fundamental principles of traditional food processing and preservation in Nigeria.</p>	<p>Explain with aid of agricultural vegetation map of Nigeria</p>	<p>Map of Nigeria</p>

WEEK	General Objective: ACQUIRE AN INTRODUCTORY KNOWLEDGE OF RURAL AGRICULTURE IN NIGERIA		
1-2	Special Learning Objectives:	Teachers Activities	Resources
	<p style="text-align: center;"><u>Rural Agriculture in Nigeria</u></p> <p>1.1 Define Agriculture and explain the various agricultural systems in Nigeria.</p> <p>1.2 Explain subsistence farming in Nigeria.</p> <p>1.3 List the various factors affecting food production in rural Nigeria e.g. Land Tenure system, mechanization, farm inputs etc.</p> <p>1.4 Describe the relationship between population growth and food availability in Nigeria.</p>	<p>Explain with the aid of agricultural vegetation map of Nigeria</p>	<p>Map of Nigeria</p>
	General Objective: ROLE OF GOVERNMENT IN NATIONAL FOOD SECURITY		
	<p style="text-align: center;"><u>National Food Security</u></p> <p>1.5 Identify government agencies involved in food production in Nigeria.</p> <p>1.6 Outline government policies on food production in Nigeria</p> <p>1.7 Explain the role of private sectors in food production in Nigeria.</p>	<p>Explain with this aid of vegetation/relief map</p>	<p>Map of Nigeria</p>

WEEK	General Objective: OUTLINE OF THE SCOPE OF FOOD TECHNOLOGY		
3	Special Learning Objectives:	Teachers Activities	Resources
	<u>Scope of food Science and Technology</u>		
	2.1 Outline the scope of Food Science and Technology.	Explain with a chart	Teaching Tools
	2.2 Describe the roles of Food Science and Technology in food processing and storage.	“	“
	2.3 Outline the basic principles and methods of food preservation	“	“
	2.4 List the major factors responsible for food spoilage.	“	“
	2.5 Explain food fortification	“	“
2.6 Explain the control of actions of microorganisms by the following: heat, cold, chemicals, irradiation, acidity, salt, smoke.	“	“	
2.7 Explain the effect of heat treatment; use of various chemicals, irradiation etc on food enzymes.	“	“	
4	General Objective: KNOW THE SCOPE OF FOOD COMMODITIES		
	<u>Scope of food commodities</u>		
	3.1 Define food commodities.	Students should identify and sketch indigenous crops	Crop samples
	3.2 Identify food commodities of plant origin.	“	Crop form
3.3 Identify food commodities of animal origin.	“	“	
	“	“	

WEEK	General Objective: UNDERSTAND PRE. AND POST HARVEST FACTORS AFFECTING FOOD PRODUCTION IN THE TROPICS		
	Special Learning Objectives:	Teachers Activities	Resources
7	<p data-bbox="436 321 1003 354" style="text-align: center;"><u>Factors affecting food production in Nigeria</u></p> <p data-bbox="247 393 1192 500">5.1 Explain the influence of environmental factors such as soil, rainfall, temperature, pest and etc on the qualitative and quantitative properties of primary agricultural products in Nigeria.</p> <p data-bbox="247 539 1192 604">5.2 Explain the role of breeding on the quality of agricultural products (plants and animals)</p> <p data-bbox="247 646 1192 753">5.3 Explain the role of cultural techniques such as; land preparation, fertilizer application, harvesting methods, handling etc on the quality of primary agricultural products.</p> <p data-bbox="247 795 1192 860">5.4 Explain the relationship between control of maturation (including ripening of fruits) and quality of primary agricultural products.</p>	<p data-bbox="1218 393 1579 457">Demonstrate with harvested corps</p>	<p data-bbox="1625 393 1822 425">harvested corps</p>

General Objective: UNDERSTAND STORAGE PROBLEMS OF LOCALLY PRODUCED FOOD ITEMS			
8 – 9	<u>Storage problems of food item</u>		
	6.1 Explain the importance of storage in food availability.	Show students real life rhombus, yam barn e.t.c	Rhombus, yam barn e.t.c
	6.2 Describe traditional methods of storage e.g. Rhombus, traditional yam barns.		
	6.3 List the merits and demerits of the traditional system of food storage list in 6.2 above.		
	6.4 Explain the principles of modern storage and describe the main types of silos, refrigerated storage, controlled atmospheric storage etc.	Conduct practicals to construct the structures for use	Sticks, mud, ropes
	6.5 Explain the advantages and limitations of modern systems of storage especially with regards to rural Nigeria farming.		
	6.6 Construct traditional yam barn, maize crib and rhombus.		
6.7 Observe the limitations of the structures in 6.6 above in long term and large-scale storage in rural Nigeria.	Take weekly readings on effectiveness of the structure and their maintenance problems.		

WEEK	General Objective: UNDERSTAND THE FUNDAMENTAL PRINCIPLES OF TRADITIONAL FOOD PROCESSING AND PRESERVATION IN NIGERIA		
	Special Learning Objectives:	Teachers Activities	Resources
10 - 15	<u>Traditional food processing and preservation</u>		
	7.1 Identify traditional foods of plant and animal origin in Nigeria.	Conduct students on physical identification	Plant and animal foods
	7.2 Describe traditional methods of fruits and vegetable processing preservation and storage in Nigeria.		
	7.3 Explain the merits and demerits of the various methods in 7.2 above e.g. sun drying, fermentation, salting etc.		Teaching Tools
	7.4 Preserve some common vegetables in Nigeria e.g. Bitter-leaf, spinach, waterleaf, okro, ugwu etc using sun drying, oven.	Conduct practicals to preserve listed items	Blancher, cabinet drier, Deep freezer, sealing machine.
	7.5 Describe the various local methods of processing the various tuber and root crops in Nigeria e.g. yam to produce yam flour, chips, cassava to produce garri, fufu, etc.	Supervise practicals to package listed items	
	7.6 Produce and package flour from yam; cassava, and other local roots and tubers.	Conduct practicals to package listed items	Slicing machine, drier, attrition mill/hammer mill, sieve, sealing machine.
	7.7 Describe the various methods of garri processing in Nigeria.		Teaching Tools
7.8 Produce and package flour from various local grains, legumes and cereals e.g. maize into ogi, soya flour etc.	Conduct practicals to produce listed items	Rotary drier, hammer mill, sieve and sealing machine.	

WEEK	General Objective: UNDERSTAND THE FUNDAMENTAL PRINCIPLES OF TRADITIONAL FOOD PROCESSING AND PRESERVATION IN NIGERIA		
	Special Learning Objectives:	Teachers Activities	Resources
	7.9 Describe the various methods of meat and fish processing and preservation in Nigeria. E.g. drying, salting, smoking etc.		Smoking kilns, salting vats, cabinet drier, sealing machine.
	7.10 Produce, preserve and package meat and fish by smoking, salting, drying etc.	Conduct practicals to produce listed items	“
	7.11 Describe the various ways of processing and preserving various spices commonly used in Nigeria.		
	7.12 Produce and package various species e.g. pepper, etc.	Conduct practicals to produce listed items	Sorting machine, drier, hammer/attrition mill, sieving and sealing machine
	7.13 Describe the various methods used in processing and preserving fruits in Nigeria.	Lecture	Teaching Tools
	7.14 Produce and package juices, preserves/jams from fruits e.g. orange, pineapple, mango etc.	Conduct practicals to produce listed items	Peeling machine, Juice extractor/pupling mixing machine, bottle filling/crowning machine, pastuerizer.
	7.15 List the various types of locally produced wines and beverages in Nigeria.		Teaching Tools
	7.16 Describe the methods of manufacture and preservation of the wines in 7.15 above.	Conduct practicals to construct the structures	

Practical content FST 111 Introduction to food science and commodities

	Practicals	Teachers Activities	Resources
Week 4	3.2 Identify food commodities of plant origin 3.3 Identify food commodities of animal origin	Students should identify and sketch indigenous crops.	Crop sample Crop farm
5-6	4.2 Identify the common livestock found in Nigeria 4.3 Identify the different species of each breed of livestock in 4.2 above and the raw materials obtained from each breed e.g diary cow (milk), hen(egg) broiler(meat)	Visit to life stock farm	Trip
8-9	6.6 construct traditional yam barn, maize crib and rhombus.	Conduct practical to construct the structures for use.	Sticks, mud, ropes
10-15	7.1 Identify traditional foods of plant and animals origin in Nigeria.	Conduct students on physicals identification	Plant and animal foods.
	7.4 preserve some common vegetables in Nigeria e.g better-leave, spinach , water leave, okro, ugwu, e.t.c using sun dry oven.	Conduct practical to package listed items.	Slicing machine, drier attraction mill/hammer, mill, sieve, sealing machine.
	7.7 produce and package flour from various local grains, legumes and cereals e.g maize into ogi, soya flour e.t.c.	Conduct practicals to listed items package	Rotary driver, hammer mill, sieve, sealing machine.
	7.10 produce preserve and package meat and fish by smoking, salting, drying e.t.c.	Conduct practicals to produce listed items.	Smoking kilns, salting vats, carbinet driver. Hammer/attention mill, sieving and sealing machine
	7.12 produce and package various spices e.g pepper	Conduct practicals to produce listed items.	Sorting machine, driver, Hammer/attention mill, sieving and sealing machine

	7.14 produce and package juices, preserve jams from fruits e.g orange, pineapple, mango e.t.c	Conduct practicals to produce listed items.	Peeling machine, juice extractor/pupling mixing machine, bottle filling/crowning machine, pasteurizer,
	7.17 produce preserve and package some local wines, pito, palmwine, burukutu e.t.c malt drinks	Conduct practicals to produce listed items.	Fermenter, pasteurizer, sieving machine, bottling/ crowning machine.
	7.19 extract oil from palm fruits,palm kernel, melon seeds etc	Conduct practicals to produce listed items.	Oil extraction server press, sieving machine bottling/ crowning machine.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD CHEMISTRY		Course Code: FST 121	Contact Hours: (1-0-3)
Course Goal: this course is designed to introduce students to the chemical nature of foods			
WEEK	General Objectives UNDERSTAND THE CHEMICAL NATURE OF FOOD		
	Special Learning Objectives: 6	Teachers Activities	Resources
15	<p>On completion of this course, the student should be able to:</p> <p>1.0 Understand the chemical nature of food.</p> <p>2.0 Understand the nature of carbohydrates.</p> <p>3.0 Understand the nature of fats and oil on food.</p> <p>4.0 Understand the nature of amino acids.</p> <p>5.0 Understand the nature of proteins.</p> <p>6.0 Know the characteristics of enzymes in food.</p> <p>7.0 Understanding the nature of vitamins.</p> <p>8.0 Understand browning reaction.</p> <p>9.0 Understand the characteristics of additives in foods.</p> <p>10.0 Understand the characteristics of colloids.</p> <p>11.0 Understand the role of water in food.</p>		

WEEK	General Objectives UNDERSTAND THE NATURE OF CARBOHYDRATES		
	Special Learning Objective:	Teachers Activities	Resources
3 - 5	<u>Carbohydrates</u>		
	2.1 List the most common sources of carbohydrates.	Display carbohydrate food	Carbohydrate off
	2.2 Describe the physical and chemical nature of carbohydrates.		
	2.3 Test for carbohydrates in the laboratory.		
	2.4 Explain the nutritional and industrial importance of carbohydrates.	Conduct practical test for carbohydrates tests grade student individual reports.	Reagents, Polarimeter, Refractometer.
	2.5 Classify carbohydrates into mono, oligo and polysaccharides and explain their physical and chemical natures.	Lecture	
	2.6 Explain the relationship between mono, oligo and polysaccharides.	“	
	2.7 Identify common monosaccharides.	Lecture	“
	2.8 State the structure of monosaccharides.	Practical: Identification of monogachands, grade report	
	2.9 Explain the significance of the structure of monosaccharides and explain their chemical properties.	Lecture	
	2.10 Describe the nature occurrence, physical and chemical properties of glucose, galactose, mannose, fructose, sorbose.	“	
2.11 Describe the nature of oligosaccharides.	“		
	“		

WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>2.12 List and describe the most common oligosaccharides.</p> <p>2.13 Classify oligosaccharides into disaccharides, trisaccharides and tetrasaccharides.</p> <p>2.14 List the sources of the most common oligosaccharides.</p> <p>2.15 List and identify the physical and chemical properties of oligosaccharides in the laboratory.</p> <p>2.16 Describe the physical nature of disaccharides.</p> <p>2.17 List the disaccharides of most interest in food chemistry: lactose, maltose and sucrose.</p> <p>2.18 Distinguish between reducing and non-reducing sugars in the laboratory.</p> <p>2.19 Describe the nature occurrence, physical and chemical properties of lactose, maltose and sucrose.</p> <p>2.20 State the structural formula of disaccharides.</p> <p>2.21 Explain the significance of the formula of disaccharides.</p> <p>2.22 Identify the most common sources of disaccharides.</p>	<p>conduct practicals on reducing and non reducing sugar</p> <p>Lecture</p> <p>Display disaccharides food.</p>	<p>reagents</p> <p>Glassware reagents</p> <p>Food items</p>

WEEK	General Objective:		
	Special Learning Objectives:	Teachers Activities	Resources

WEEK	General Objectives UNDERSTAND THE NATURE OF FATS AND OILS ON FOODS		
	Special Learning Objective:	Teachers Activities	Resources
6 - 7	<u>Fats and Oils in Food</u>		
	3.1 Identify the natural sources of fats and oils.	Display the sources of fat and oils	fat and oils
	3.2 Describe the composition of fats and oils.		
	3.3 Describe the physical and chemical properties of fats and oils.		
	3.4 Differentiate Lipid materials from Waxes.	Display lipid and waxes	Teaching Tools
	3.5 List the names, formulae and sources of fatty acids of importance in the food industry.		
	3.6 Differentiate between the composition of crude and pure fats and oils.	Lecture	Teaching Tools
	3.7 Identify edible fats and oils.	Display edible fat and oils	Edible fats and oils
	3.8 Explain non-acidity and flavour changes in fats and oils.		
	3.9 Describe the process for the recovery and refining of fats and oils.		
	3.10 Explain the term hydrogenation of fats and oils.		
	3.11 List and describe the nutritional and industrial importance of fats and oils.		
3.12 Test for fats and oils in the laboratory	Conduct practicals on text for fats and oils	Laboratory equipment	

WEEK	General Objective: UNDERSTAND THE NATURE OF AMINO ACIDS		
8	Special Learning Objectives: <u>Amino Acids</u> 4.1 Define amino acids. 4.2 List amino acids of nutritional and industrial importance. 4.3 Classify amino acids into essential and non-essential. 4.4 Explain the nutritional and industrial importance of amino acids. 4.5 State the functions of amino acids. 4.6 List and describe the properties of proteins. 4.7 Describe common sources of amino acids. 4.8 Test for common amino acids in the laboratory.	Teachers Activities Conduct practicals on test for amino acids. Grade reports.	Resources Microkjeldhal apparatus.

WEEK	General Objective: UNDERSTAND THE NATURE OF PROTEINS		
	Special Learning Objectives:		

<p>9 – 10</p>	<p style="text-align: center;"><u>Proteins</u></p> <p>5.1 Describe the nature of proteins.</p> <p>5.2 List the natural sources of proteins.</p> <p>5.3 Describe the physical and chemical properties of proteins.</p> <p>5.4 Test for proteins in the laboratory applying various methods.</p> <p>5.5 Classify proteins into simple, conjugated, derived.</p> <p>5.6 Explain the configuration of proteins.</p> <p>5.7 Explain the following properties of proteins: amphoterism, solubility, colour reaction, hydrolysis.</p> <p>5.8 Determine experimentally the properties of proteins in 5.7 above</p> <p>5.9 Explain the building process of proteins.</p> <p>5.10 Explain the term denaturation.</p> <p>5.11 Differentiate between native and denatured proteins.</p> <p>5.12 Explain the causes of denaturation in proteins.</p> <p>5.13 Explain the significance of protein denaturation in food processing.</p> <p>5.14 Describe the functional properties of proteins in food systems.</p>	<p>Lecture</p> <p>Display food sources of protein</p> <p>Conduct practical test for protein. Grade report.</p> <p>Conduct practicals and grade reports.</p>	<p>Food samples</p> <p>Glass wares Kjeldhal apparatus</p> <p>Teaching Tools</p>
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WEEK	General Objectives KNOW THE CHARACTERISTICS OF ENZYMES IN FOOD.		
11	Special Learning Objective:	Teachers Activities	Resources
	6.1 Define enzymes. 6.2 Identity enzymes associated with important classes of food. 6.3 List and describe properties of enzymes. 6.4 Explain the catalytic action of enzymes 6.5 Explain the mechanism of enzymes action. 6.6 Explain the factors affecting enzymes activity. 6.7 Classify enzymes according to their activities 6.8 Describe methods of enzyme inactivation 6.9 Describe importance of enzymes in food processing.		
WEEK	General Objective: 7.0 UNDERSTANDING THE NATURE OF VITAMINS		
12 – 13	Special Learning Objectives:	Teachers Activities	Resources
	7.1 Define vitamins 7.2 List sources of Vitamins 7.3 List and describe the physical and chemical properties of vitamins. 7.4 Classify vitamins based on their solubility 7.5 Identity the precursors of different vitamins in food. 7.6 State the functional properties of vitamins in food. 7.7 Explain the nutritional significance of vitamins in food. 7.8 Determine vitamins, A,B,B2, C, D and Niacin in the laboratory	Conduct practicals to identify precursors and vitamins	
WEEK	General Objective: 8.0 UNDERSTAND BROWNING REACTION		
12	Special Learning Objectives:	Teachers Activities	Resources
	8.1 Explain Browning reaction 8.2 Explain enzymic and non- enzymic browning. 8.3 Explain effects of browning on food quality. 8.4 Describe methods of controlling browning reactions in food.	Explain with examples e.g. cut yam	Cut yam

WEEK	General Objective: 9.0 UNDERSTAND THE CHARACTERITICS OF ADDITIVES IN FOODS		
13	Special Learning Objectives:	Teachers Activities	Resources
	9.1 Define food additives 9.2 Identify natural and man- made food additives 9.3 Classify additives in foods based on their functions. 9.4 Differentiate between incidental and intentional additives. 9.5 Describe the effects of additives on texture, odour and colour of foods. 9.6 Explain the limitations in the qualitative analysis of food additives 9.7 Describe methods of qualitative analysis of additives in food.	Display vanons natural and artificial	Additives
WEEK	General Objective: 10.0 UNDERSTAND THE CHARACTERISTICS OF COLLOIDS		
14	Special Learning Objective:	Teachers Activities	Resources
	10.1 Explain the meaning of the term – COLLOIDS 10.2 List colloidal systems in foods 10.3 Explain the properties of colloids 10.4 List example of the uses of emulsifying agents	Display emulsifying agents	Emulsifying agents
WEEK	General Objectives: 11.0 UNDERSTAND THE ROLE OF WATER IN FOOD		
15	Special Learning Objective:	Teachers Activities	Resources
	11.1 Explain the states of water in food i.e. free and bound water. 11.2 Explain the role of water in food i.e. either as solvent, reactant etc. 11.3 Define water – activity in foods. 11.4 Explain the importance of water activity of food systems i.e. shelf-life, browning reaction etc	solvent properties of water	glassware

Food chemistry FST 121

	Practicals	Teachers Activities	Resources
Week 1-2	1.2 Classify the food items in 1.1 above (common food items found in various parts of Nigeria.) into tuber grains, cereals, vegetable.	Display the food items	Various food items; yam, cassava, fruit, vegetables, etc
	1.5 Identify the food deficiency diseases associated with lack of the nutrients in 1.4 [carbohydrate, proteins, fats minerals and vitamins]	Conduct field trip to nutritional clinic	nutritional clinic
	1.7 Identify the food constituents of the major food items found in Nigeria e.g garri,-carbohydrate.		
3-5	2.3 Test for carbohydrate in the laboratory.	Conduct practical test for carbohydrates.	Reagent, polarimeter, Refractometer.
	2.7 Identify common monosacharides	Practical identification of monosacharides grade report.	
	2.22 Identify the most common sources of disaccharides	Display disaccharides foods.	Food item
6-7	3.1 Identify the natural sources of Fats and oils.	Display the sources of fats and oil	Fats and oil
	3.7 Identify edible Fats and oils	Display edible Fats and oils	edible Fats and oils
	3.12 test for Fats and oils in laboratory.	Conduct practicals on test for fats and oil	Laboratory equipment
8	4.8 test for common amino acid in the laboratory	Conduct practicals on test for amino acid grade report.	Micro, Kjeldahl apparatus
9-10	5.4 test for proteins in the laboratory applying various methods	Conduct practicals on test for protein grade report.	Glassware Kjeldahl apparatus
	5.8 determine experimentally the properties of proteins in amphotentially colour reaction, hydrolysis.	Conduct practicals and grade report.	

12-13	7.5 Identify the precursors of different vitamins in food. 7.8 Determine vitamins A,B,B2,C,D and Niacin in the laboratory.	Conduct practicals to identify precursors and vitamins.	
13	9.2 Identify the natural and man-made food additives	Display various natural and artificial additives.	additives.

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: FOOD PROCESSING AND PRESERVATION
CODE: FST 122
DURATION: (Hours/Week) Lecture 2 Tutorial 0 Practical 3
UNIT: 3.0
GOAL: This course is designed to enable students to understand the basic principles of FOOD PROCESSING AND PRESERVATION
GENERAL OBJECTIVES: On completion of this course the student should be able to:
1.0 Understand the causes of food spoilage.
2.0 Know the classification of food based on their Hydrogen ion concentration.
3.0 Understand the principles of how temperature preservation of food.
4.0 Understand the preservation of food by thermal process.
5.0 Understand the fundamental of food canning as a method of food preservation.
6.0 Understand the preservation of food by irradiation.
7.0 Understand the principles of preservation of food by controlled reduction in moisture content.
8.0 Understand the preservation of food by fermentation.
9.0 Understand the principles of food preservation by controlled environment.
10.0 Understand the principles of chemical preservation of food.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: PRINCIPLES OF FOOD PROCESSING AND PRESERVATION		Course Code: FST 122	Contact Hours: (2-0-3)
Course Goal: This course is designed to enable students understand the basic principles of food processing and preservation.			
WEEK	General Objective:		
	Special Learning Objectives:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Understand the causes of food spoilage.</p> <p>2.0 Know the classification of foods based on their hydrogen ion concentration.</p> <p>3.0 Understand the principles of low temperature preservation of foods.</p> <p>4.0 Understand the preservation of food by thermal process.</p> <p>5.0 Understand the fundamental of food canning as a method of food preservation.</p> <p>6.0 Understand the preservation of food by irradiation.</p> <p>7.0 Understand the principles of preservation of food by controlled reduction in moisture content.</p> <p>8.0 Understand the preservation of food by fermentation.</p> <p>9.0 Understand the principles of food preservation by controlled environment.</p> <p>10.0 Understand the principles of chemical preservation of food.</p>		

General Objectives UNDERSTAND THE PRINCIPLES OF LOW TEMPERATURE PRESERVATION OF FOODS		
4	<u>Law temperature storage</u>	
	3.1 List the components of refrigerator.	Show students the components
	3.2 Describe the importance of heat load.	“
	3.3 Describe spoilage problems associated with refrigerated foods.	“
	3.4 Describe various freezing methods.	“
	3.5 Explain the effects of storage conditions on frozen foods.	“
	3.6 Differentiate between refrigeration and freezing.	“
	3.7 Explain the effects of freezing on fruits and vegetables.	“
		Refrigerator

WEEK	General Objectives UNDERSTAND PRESERVATION OF FOOD BY THERMAL PROCESS		
	Special Learning Objectives	Teachers Activities	Resources

5 – 6	<p style="text-align: center;"><u>Preservation by thermal process</u></p> <p>4.1 State the two main objectives of thermal processing</p> <p>4.2 Describe the effects of various forms of heating methods on microorganisms e.g. cooking, steaming, etc.</p> <p>4.3 State the objectives of pasteurization and sterilization of foods.</p> <p>4.4 Describe various methods of pasteurization and sterilization.</p> <p>4.5 Pasteurize milk and other food items.</p> <p>4.6 Differentiate between pasteurization and sterilization.</p> <p>4.7 Define the term blanching.</p> <p>4.8 Describe various methods of blanching.</p> <p>4.9 List the advantages and disadvantages of blanching</p> <p>4.10 Prepare and blanch some common vegetables by (a) Steam blanching (b) Water blanching</p> <p>4.11 Package blanched vegetables and compare with un-blanched vegetables after a period of storage.</p>	<p>Conduct practicals and grade report on pasteurizing, blanching and packageing.</p> <p>“</p> <p>“</p> <p>“</p> <p>conduct practicals on blanching and grade reports</p> <p>“</p> <p>“</p>	<p>Heating pasteurizing, equipment</p> <p>Blanching vats</p> <p>“</p> <p>Polysealer</p>

WEEK	General Objectives UNDERSTAND THE FUNDAMENTAL OF FOOD CANNING AS A METHOD OF FOOD PRESERVATION		
7 – 8	Special Learning Objectives	Teachers Activities	Resources
	<u>Fundamentals of canning</u>		
	5.1 Outline the development of canning as a method of food preservation.	Take students on visit to canning factory	Field trip.
	5.2 Describe the various unit operations involved in canning of various types of foods e.g. cleaning, sorting, size reduction, blanching etc.	“	“
	5.3 Explain the following terms: Thermal death time; D – value, Z – value and F – value.	“	“
	5.4 List and explain factors that affect heat penetration of cans and contents.	“	“
	5.5 Explain types of heat transfer encountered in solid, liquid and mixed canned products.	“	“
	5.6 Estimate slowest heating points in canned products under still and agitated heating conditions.	“	“
	5.7 List and explain factors normally considered for temperature – Time combinations for processing		
	5.8 Explain the following types of processes: hot water/air, steam processing, batch and continuous processing, open batch processing, steam retorting, aseptic canning methods.		
5.9 Describe the techniques of can testing and seaming.			

WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	5.10 Explain features of industrial retort and methods of care and management. 5.11 Can some food items e.g. fish and sauce. Tomato puree etc.	Conduct Practical on canning and grade reports.	Industrial visit Canning line/Machine, Blancher
9	General Objective: UNDERSTAND THE PRESERVATION OF FOOD BY IRRADIATION		
	<u>Preservation by irradiation</u> 6.1 Define irradiation. 6.2 State the principles of irradiation. 6.3 Describe the various sources and types of irradiation employed in food preservation. 6.4 Explain the effects of irradiation on foods. 6.5 Describe future prospects of irradiation as a method of food preservation	“ “ “ “ “	“ “ “ “

WEEK	General Objectives UNDERSTAND THE PRINCIPLES OF PRESERVATION OF FOOD BY CONTROLLED REDUCTION IN MOISTURE CONTENT		
	Special Learning Objectives:	Teachers Activities	Resources
10 – 11	<u>Preservation of food by Dehydration</u>		
	7.1. Define dehydration, drying.	Show fresh and dried produce	fresh and dried produce
	7.2 Differentiate between dehydration and drying.		Teaching Tools
	7.3 Explain the principles of dehydration.		Teaching Tools
	7.4 List and describe various methods of dehydration.		Teaching Tools
	7.5 State the temperature ranges for dehydration of various classes of foods.	Practical/Identification Lecture “	“
	7.6 Identify common dehydration equipment.		Dehydration equipment Drying vats
	7.7 Explain quality deterioration during dehydration and storage of foods.		
7.8 Explain the principles of evaporation, condensation and concentration.			

WEEK	General Objectives UNDERSTAND PRESRVATION OF FOOD BY FERMENTATION		
12 - 13	Special Learning Objective:	Teachers Activities	Resources
	<u>Preservation by Fermentation</u> 8.1 Define and state the objectives of fermentation. 8.2 List the various types of fermentation. 8.3 List examples of fermented foods in Nigeria. 8.4 Produce and package some fermented foods, Iru, Yogurt etc.	Show example of fermented food. “ “ “ conduct Practicals to produce items. Grade quality of product and reports.	fermented food. “ “ Fermentation vats
14	General Objectives UNDERSTAND THE PRINCIPLES OF FOOD PRESERVATION BY CONTROLLED ENVIRONMENT.		
	Special Learning Objectives:	Teachers Activities	Resources
	<u>Preservation by Controlled by Environment</u> 9.1 Explain the meaning of “Controlled environment”. 9.2 List specific examples of food preservation by controlled environment 9.3 Explain the effects of controlled environment on the physiological and biochemical changes observed in intact foods of plant and animal origin.		

WEEK	General Objectives UNDERSTAND THE PRINCIPLES OF CHEMICAL PRESERVATION OF FOODS.		
15	Special Learning Objectives:	Teachers Activities	Resources
	<p style="text-align: center;"><u>Chemical Preservation of Food</u></p> <p>10.1 Identify chemicals used in food preservation.</p> <p>10.2 Explain the effects of the chemicals listed in 10.1 on food preservation, storage and quality.</p> <p>10.3 Explain the possible health hazards associated with chemical preservations in food.</p> <p>10.4 Produce and preserve food with known chemicals and compare with foods without chemicals after a period of storage.</p>	<p>Practical identification of preservation agents</p> <p>Lecture</p> <p>“</p> <p>Conduct Practical and grade reports.</p>	<p>Preservation reagents</p> <p>Teaching Tools</p> <p>“</p> <p>Mixing machine, sealing machine</p>

FST 121 PRACTICALS PRINCIPLES OF FOOD PROCESSION AND PRESERVATION

	PRACTICALS	TEACHERS ACTIVITY	RESOURCES
WEEK 1-2	1.7 Isolate food spoilage micro organisms from spoiled fruits, vegetables and cooked foods.	Conduct practicals and grade report.	Microscope, media
	1.8 Identify insects and rodents responsible for food spoilage.	Conduct practicals and grade report.	Preserved insects and rodents
3	2.2 Identify food spoilage organisms associated with low and high acid foods.	Conduct practicals on isolation of micro organisms and grade report.	micro organisms
	2.4 measure PH of various food items.	Conduct practicals and grade report.	PH meter
5-6	4.5 pasteurize milk and other food items	Conduct practicals and grade report.	Heating pasteurizing equipment.
	4.10 Prepare and blanch some common vegetables by: (a) steam blanching (b) water blanching 4.11 package blanched vegetables and compare with un blanched vegetables after a period of storage.	Conduct practicals on blanching and grade report. “	Blanching vats polysealer
7-8	5.11 can some food items e.g fish and sauce tomato puree etc	Conduct practicals on canning and grade report	Canning line machine and blancher.
10-11	7.6 Identify common dehydration equipment	Practical/Identification	Dehydration equipment. Drying vats.
12-13	8.4 Produce and package some fermented foods, Iru, yogurt etc.	Conduct practicals to produce items. Grade quality of product and reports.	Fermentation vats.
15	10.0 identify chemicals used in food preservation.	Practical/Identification	Preservation reagent
	10.4 Produce and preserve food with known chemicals and compare with foods without chemicals after a period of storage.	Conduct practicals and grade report.	Mixing machine, sealing machine.

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: FOOD BIOCHEMISTRY
CODE: FST 211
DURATION: (Hours/Week) Lecture 1 Tutorial 0 Practical 0
UNIT: 1.0
GOAL: This course is designed to enable students with an introductory knowledge of bio chemistry of foods.

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

- 1.0 Understand the biochemical organization of the cell
- 2.0 Understand the metabolism of carbohydrate
- 3.0 Understand the modification and applications of carbohydrate in food.
- 4.0 Understand the metabolism of lipids.
- 5.0 Understand the metabolism of amino acids.
- 6.0 Know the TCA cycle and its importance
- 7.0 Understand changes that occur in the ripening and maturation of fruits.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD BIOCHEMISTRY		Course Code: FST 211	Contact Hours: (1-0-0)
Course Specification: THEORETICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Understand the biochemical organization of the cell.</p> <p>2.0 Understand the metabolism of carbohydrates.</p> <p>3.0 Understand modifications and applications of carbohydrates in food.</p> <p>4.0 Understand the metabolism of lipids.</p> <p>5.0 Understand the metabolism of amino acids.</p> <p>6.0 Know the TCA cycle and its importance.</p> <p>7.0 Understand changes that occur in ripening and maturation of fruits.</p>		

Week	General Objectives UNDERSTAND THE BIOCHEMICAL ORGANISATION OF THE CELL		
1 - 2	Special Learning Objectives:	Teachers Activities	Resources
	<u>Biochemical organization of the cell</u> 1.1 Describe the internal structure of the cell 1.2 Explain the biochemical components of the internal parts of the cell. 1.3 Explain the functions of the various internal components of the cell.		Teaching Tools Teaching Tools Teaching Tools
3 - 5	General Objectives UNDERSTAND THE METABOLISM OF CARBOHYDRATES		
	<u>Metabolism of carbohydrates</u> 2.1 Describe the light and dark phases of photosynthesis. 2.2 Describe the digestion and absorption of carbohydrates in mammals. 2.3 Describe the transport and storage of carbohydrate in mammals. 2.4 Describe the glycolytic pathway. 2.5 Describe the alcoholic fermentation reactions. 2.6 Explain the importance of tissue glycogen. 2.7 Compare glycogenolysis and glycogenesis processes. 2.8 Explain control mechanisms of carbohydrate metabolisms.	Use charts to explain photosynthesis partway etc Explain with Chart of partway “ “ “ “ “	Charts Charts of part way “ “ “ “ “

Week	General Objectives UNDERSTAND MODIFICATIONS AND APPLICATIONS OF CARBOHYDRATES IN FOOD		
	Special Learning Objectives:	Teachers Activities	Resources
6 - 8	<u>Application of carbohydrates in food</u>		
	3.1 Explain, modify and derive carbohydrates.	Show examples of 3.1 “	CHO foods
	3.2 Explain the uses of modified and derived starches.	“	
	3.3 Describe gelatinization of starch.	“	Food samples
	3.4 Explain retro gradation and staling of bread.	show examples of pectin in food	“
	3.5 Identify the uses of pectin substances in food.	“	“
	3.6 Classify pectic substances.	“	“
	3.7 Describe the structure of pectin substances.	“	“
	3.8 Describe the occurrence of pectic substances and their distribution.	“	“
	3.9 Explain chemical composition of pectic substances.		“
3.10 Explain the theory of gel formation by pectins in the presence of acid.		“	

Week	General Objectives UNDERSTAND THE METABOLISM OF LIPIDS		
9	<u>Metabolism of Lipids</u>		Use model of alimentary canal model
	4.1 Describe digestion and absorption of lipids in man.		
	4.2 Describe transport and storage of lipids in man.		

Week	General Objectives UNDERSTAND THE METABOLISM OF AMINO ACIDS		
10– 11	Special Learning Objective:		Teachers Activities
	<u>Metabolism of amino acids</u>		Resources
	5.1 Describe the digestion and absorption of proteins in man.	Explain with the chart of alimentary canal	TCA Chart
	5.2 Define with examples glyconic and ketogenic amino acids.	Explain with chart of urea cycle.	Teaching Tools
	5.3 Describe the urea cycle.		Teaching Tool
General Objectives KNOW THE TCA CYCLE AND ITS IMPORTANCE			
12 - 13	<u>The TCA cycle</u>		
	6.1 Describe the TCA cycle.	Explain with the aid of TCA chart	TCA Chart
	6.2 Explain the relationship between glycolysis and oxidation of fat and amino acid through the TCA cycle.	“	“
	6.3 Explain the regulation of TCA cycle	“	“
	6.4 Explain the relationship between the protein sparing aspect of fats and carbohydrates and TCA.		

General Objective UNDERSTAND CHANGES THAT OCCUR IN RIPENING AND MATURATION OF FRUITS			
14 - 15	<u>Changes in ripening and maturation of fruits</u>		
	7.1 Identify physical changes during maturation and ripening of fruits.		7.4 Describe using fruits ripening at different stages.
	7.2 Describe biochemical changes during maturation and ripening of fruits.		“
	7.3 Explain factors affecting changes in quality of fruit during storage and transportation.		“
			Ripening fruits.

PROGRAMME:	FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE:	FOOD ANALYSIS
CODE:	FST 212
DURATION:	(Hours/Week) Lecture 2 Tutorial 0 Practical 3
UNIT:	3.0
GOAL:	This course is designed to enable students undertake analysis of foods for its quality.
GENERAL OBJECTIVES:	<p>On completion of this course the student should be able to:</p> <ol style="list-style-type: none"> 1.0 Understand the sampling of foods. 2.0 Understand the concept of proximate analysis of food 3.0 Understand the nature of water in food 4.0 Understand the nature of fats in food and their method of analysis 5.0 Understand methods of protein determination 6.0 Understand methods of carbohydrate determination in food. 7.0 Understand the analytical procedure for trace elements in food 8.0 Understand the analytical procedure for fats and water soluble vitamin in food. 9.0 Understand the nature of fiber in food and its method of determination. 10.0 Understand the importance and methods of analyzing food additives.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD ANALYSIS		Course Code: FST 212	Contact Hours: (2-0-3)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Understand the Sampling of food.</p> <p>2.0 Understand the concept of proximate analysis of food.</p> <p>3.0 Understand the nature of water in food.</p> <p>4.0 Understand the nature of Fats in food and their method of analysis.</p> <p>5.0 Understand method of protein determination.</p> <p>6.0 Understand method of carbohydrate determination in food.</p> <p>7.0 Understand the analytical procedures of trace elements in food.</p> <p>8.0 Understand the analytical procedures for fat and water-soluble vitamins in food.</p> <p>9.0 Understand the nature of fibre in food and its methods of determination.</p> <p>10.0 Understand the importance and methods of analyzing food additives.</p>		

Week	General Objectives UNDERSTAND THE SAMPLING OF FOOD		
1	Special Learning Objective:	Teachers Activities	Resources
	1.1 Define sampling. 1.2 describe the various sampling methods. 1.3 Sample food for statistical analysis.	Conduct practicals on food sampling	Sterile container.
2	General Objectives UNDERSTAND THE CONCEPT OF PROXIMATE ANALYSIS OF FOOD		
	Special Learning Objective:		
	2.1 Define proximate composition of food. 2.2 Describe methods of handling and preparation of food samples for analysis 2.3 Prepare food samples for analysis. 2.4 Distinguish between proximate and ultimate analysis. 2.5 Explain the sources of error in analysis for any component in food. 2.6 Explain the differences between accuracy and precision of analytical instrument. 2.7 Differentiate between absolute and empirical methods in food analysis	Demonstrate food handling for analysis Preparation of food samples using sterile and clean contained. “ “ “ “	Food handling tools Sterile utensils “ “ “

Week	General Objectives: 3.0 UNDERSTAND THE NATURE OF WATER IN FOOD		
	Special Learning Objective:	Teachers Activities	Resources
3 - 4	3.1 Explain the need for moisture determination in the food industry. 3.2 Explain the nature of water in foods. 3.3 Explain the need to use water of appropriate quality for food processing.. 3.4 Describe the following methods of moisture determination in food, stating their advantages and limitations: (a) Evaporation by heat – hot air oven, vacuum oven, carter simon oven, infra oven. (b) Azeotropic distillation of water – Dean and stark procedure. (c) Conductivity/resistance meter – Marconi moisture meter. (d) Titrimetric method – Karl Fischer method. 3.5 Determine moisture in food by any three methods in 3.4 above and explain the comparative nature of the results.	Lecture Lecture Sire Practical instructions Lecture Practical Conduct practical and grade report	- Quick fit flask - Dean and stark tubes (2cm ³ , 5cm ³ , 10cm ³) - Condenser - Heating mantle - Marconi moisture meter - Hot air oven - Vacuum oven - Carter Simon oven - Infra oven - Glasswares - Dishes - Glass rods - Balance - Dessicator
	General Objectives:4.0 UNDERSTAND THE NATURE OF FATS IN FOOD AND THEIR METHOD OF ANALYSIS		
	Special Learning Objectives	Teachers Activities	Resources
5 - 6	<u>Fats in Food</u> 4.1 Explain the need for fat determination in the food industry. 4.2 Distinguish between fat content and fat composition. 4.3 Describe the determination of fat content by the following techniques and limitations: (a) gravimetric continuous dry extraction, e.g. Bolton-Revis method (b) gravimetric discontinuous dry extraction, e.g Soxhlet method.	Practical instructions Supervise production determination of fats	- Water - Pestle and Mortar - Soxhlet extraction unit - Desiccator - Majonnier tube - Heating mantle - Gerber centrifuge

General Objectives			
	Special Learning Objective:	Teachers Activities	Resources
	(c) gravimetric acid wet extraction- Werner Schmid process. (d) Gravimetric alkali wet extraction – Rose Gottlieb and Majoonnier processes. (e) Volumetric acid wet extraction – Gereber butyrometer, Parley bottle procedures. 4.4 Determine fat by any three of the methods explained in 4.3 above.		- Gerber milk butryometer - Rose Gottlieb tube
Week	General Objectives:5.0 UNDERSTAND METHODS OF PROTEINS DETERMINATION		
	Special Learning Objective:	Teachers Activities	Resources
7 - 8	5.1 Explain the need for protein determination in the food industry. 5.2 Describe the determination of protein by the following stating their advantages and limitations: (a) formol titration method (b) dye binding colorimetric method (c) kjeldahl method 5.3 Determine protein by the formol titration and kjeldahl methods	Supervise practical on protein determination “ Conduct practical, grade report	- Digestion unit - Distillation unit - Fume cupboard - Tubes (glassware) - Blender (Homogenizer) - Kjeldhal

Week	General Objectives:6.0 UNDERSTAND METHODS OF CARBOHYDRATE DETERMINATION IN FOOD		
	Special Learning Objective:	Teachers Activities	Resources
9 - 10	<p>6.1 Explain the need for determining carbohydrates in the food industry.</p> <p>6.2 Describe the qualitative determination of sugars by the following methods: (a) iodine test for starch (b) Molisch test for carbohydrates (c) Pearson’s qualitative test for lactose and maltose</p> <p>6.3 Describe the qualitative determination of carbohydrates and sugars by the following methods stating their advantages and limitations: (a) polarimetry (b) titrimetry by Lane and Eynon (c) chromatography (d) hydrometry (e) colorimetry</p> <p>6.4 Determine reducing sugars, non-reducing sugar, total sugars by either polarimetry and/or titrimetry in either jam or soft drink.</p>	<p>Give Practical instructions</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>Conduct practical and grade reports on determination of reducing and non reducing sugars.</p>	<p>- Polarimeter</p> <p>- Glassware</p> <p>- Colorimeter</p> <p>- Hydrometer</p> <p>-Chromatograph</p>

Week	General Objectives UNDERSTAND THE NATURE OF FIBRE IN FOOD AND ITS METHOD OF DETERMINATION		
14	Special Learning Objective:	Teachers Activities	Resources
	<u>Nature of Fibre in Food</u> 9.1 Explain the need for fibre determination in foods. 9.2 Distinguish between crude fibre and dietary fibre. 9.3 Describe the methods for the determination of crude fibre and dietary fibre in food. 9.4 Determine crude fibre in food samples	Lecture Practical Conduct practical and grade report	- Silica basins - Balance - Glassware
15	General Objectives TO UNDERSTAND THE IMPORTANCE AND METHODS OF ANALYSING FOOD ADDITIVES		
	Special Learning Objective:	Teachers Activities	Resources
	<u>Analysing Food additives</u> 10.1 Explain the need for the analysis of food additives. 10.2 Describe the analysis of food for the following: (a) preservatives (b) stabilizer (c) food colour (d) food contaminant 10.2 Determine a mixture of food colours e.g. food dye mixture.	Lecture Conduct practical and grade report	- Single beam spectrophotometer - Glassware

PRACTICAL FOOD ANALYSIS FST 212

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
1	1.3 Sample food for statistical analysis	Conduct practicals on food sampling	Sterile containers
2	2.3 Prepare food samples for analysis	Practical preparation of food samples using sterile and clean containers.	Sterile utensils
3-4	3.5 Determine moisture in food by any three method.	Conduct practicals and grade reports	Decicator/balance
5-6	4.4 Determine fat by any three of the following methods. (a) volumetric acid wet extraction-Gerber butyrometer, parley bottle procedure. (b) Gravimetric acid-wet extraction rose gottlib and majoonnier process (d) Gravimetric discontinuous dry extraction eg soxhlet method.	Conduct practicals and grade reports	
7-8	5.3 Determine protein by the formocitration and kjeldahl methods	Conduct practicals and grade reports	
	6.4 Determine reducing sugar, non-reducing sugar, total sugars, by other polarimetry/ and or titrimetry in either jam or soft drinks.	Conduct practicals and grade reports	
11-12	7.4 Determine	Conduct practicals and grade reports	
13	8.5 Determine vitamin c in food.	Conduct practicals and grade reports	
14	9.4 Determine crude fibre in food samples.	Conduct practicals and grade reports	
15	10.2 Determine a mixture of food colours e.g food dye mixture.	Conduct practicals and grade reports	

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: FOOD PROCESSING ENGINEERING
CODE: FST 213
DURATION: (Hours/Week) Lecture 1 Tutorial 0 Practical 0
UNIT: 2.0
GOAL: This course is designed to provide the student with a basic knowledge of engineering process in food industry.
GENERAL OBJECTIVES: On completion of this course the student should be able to:
1.0 Understand the role of engineering in food chemistry
2.0 Know S.I Units
3.0 Understand the use of dimensional analysis for convection of units
4.0 Understand method of solving material balance problem
5.0 Understand methods of solving energy balance problem.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD PROCESS ENGINEERING		Course Code: FST 213	Contact Hours: (1-0-0)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Understand the role of engineering in food chemistry.</p> <p>2.0 Know S.I Units.</p> <p>3.0 Understand the use of dimensional analysis for conversion of units.</p> <p>4.0 Understand method of solving material balance problems.</p> <p>5.0 Understand methods of solving energy balance problems.</p>		

Week	General Objectives UNDERSTAND THE ROLE OF ENGINEERING IN THE FOOD INDUSTRY		
1 - 3	Special Learning Objective:	Teachers Activities	Resources
	<u>Engineering in Food Industry</u> 1.1 Outline the development of modern food industry. 1.2 Describe the various areas of food processing and storage that apply engineering principles. 1.3 Sketch a generalized flow diagram of a hypothetical food processing plant 1.4 Explain the concept of unit operations.	Process workshop visiting with students	Teacher Chalk Classroom Blackboard Workshop

General Objectives KNOW S. I. UNITS			
4 - 6	Special Learning Objectives:		
	<u>S.I. Units</u> 2.1 List the seven basic S. I. Units. 2.2 Define derived units with examples. 2.3 Define the various prefixes of multiples and submultiples, e.g. micro, mega, etc.	Teaching “ “	Teacher Classroom Blackboard Chalk

Week	General Objectives UNDERSTAND THE USE OF DIMENSIONAL ANALYSIS FOR CONVERSION OF UNITS		
7 - 9	<p style="text-align: center;"><u>Use of Dimensional Analysis for Conversion of Units</u></p> <p>3.1 List the dimensions and S. I. Units for fundamental importance in food engineering.</p> <p>3.2 Define a dimensional equation.</p> <p>3.3 List examples of dimensional equations.</p> <p>3.4 List sources of conversion of factors.</p> <p>3.5 List the steps in conversion of units using the dimensional equation.</p> <p>3.6 Determine conversion factors for quantities in other units.</p> <p>3.7 Interconvert units.</p> <p>3.8 Check consistency of dimensional equations</p>	<p>Teachers Activities</p> <p>Supervise measurements</p>	<p>Resources</p> <p>Teacher Classroom Blackboard Chalk</p>

Week	General Objectives UNDERSTAND METHODS OF SOLVING MATERIAL BALANCE PROBLEMS		
	Special Learning Objectives	Teachers Activities	Resources
10 - 12	4.1 State the law of conservation of mass. 4.2 Define steady and unsteady state systems. 4.3 List the steps in solving simple material balance problems. 4.4 Solve simple material balance problems on mixing dilution drawn from food industry. 4.5 Solve material balance problem with re-cycle and by-pass streams.	Teaching	Teacher Classroom Blackboard Chalk

Week	General Objectives UNDERSTAND METHODS OF SOLVING ENERGY BALANCE PROBLEMS		
	Special Learning Objectives	Teachers Activities	Resources
13 - 15	<u>Energy balance problems</u>		
	5.1 Define the joule, specific and latent heat. 5.2 State the S. I. Units in calorimeter and dimension of the quantities. 5.3 State the law of conversion of energy. 5.4 Calculate enthalpies of reaction in non-flow systems e.g. combustion of glucose. 5.5 State the two equations for estimating heat capacities of food. 5.6 Estimate the specific capacities of some selected food of known composition. 5.7 Solve energy balance problems in flow systems i.e. as in simple heat exchangers. 5.8 Demonstrate the law of conservation of energy experimentally using calorimeters.	Practical on calorimeter for energy determination	Laboratory work. Calorimeter, Food samples.

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: FOOD MICRO BIOLOGY
CODE: FST 214
DURATION: (Hours/Week) Lecture 1 Tutorial 0 Practical 3
UNIT: 2.0
GOAL: This course is designed to enable students know the significance of micro organism in food preservation
GENERAL OBJECTIVES: On completion of this course the student should be able to:
1.0 Know sources of microbial contamination
2.0 Understand the factors affecting microbial growth
3.0 Know the techniques for the study of micro organism in food.
4.0 Understand the microbiological spoilage specific foods.
5.0 Know indices of foods sanitation and micro biological stand and criteria
6.0 Know different types of food, borne disease.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD MICROBIOLOGY		Course Code: FST 214	Contact Hours: (1-0-3)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>On completion of this course, the student should be able to:</p> <p>1.0 Know sources of microbial contamination.</p> <p>2.0 Understand the factors affecting microbial growth.</p> <p>3.0 Know the techniques for the study of microorganisms in food.</p> <p>4.0 Understand the microbiological spoilage of specific foods.</p> <p>5.0 Know indices of food sanitation and microbiological standard and criteria.</p> <p>6.0 Know different types of food borne diseases.</p>		

Week	General Objectives:1.0 KNOW SOURCES OF MICROBIAL CONTAMINATION		
	Special Learning Objective:	Teachers Activities	Resources
1 - 3	<u>Sources of microbial contamination</u>		
	1.1 Explain the mode of contamination of food by air microbes.		
	1.2 Identify microorganisms in the air.		
	1.3 Classify types of microbes in the soil.		
	1.4 Explain process of contamination of food by soil microbes.		
	1.5 Explain the importance of soil microbes in agriculture.		
	1.6 List types of microbes in water.		
	1.7 Explain the significance of enterobacteria in water testing.		
	1.8 Sample and test tap and stream water for bacteria contamination.		
	1.9 Explain the mode of contamination of food by water microbes.		
1.10 List other agents of food contamination e.g. insects.			

Week	General Objectives: 2.0 UNDERSTAND THE FACTORS AFFECTING MICROBIAL GROWTH		
	Special Learning Objective:	Teachers Activities	Resources
4 – 6	<p style="text-align: center;"><u>Factors affecting microbial growth</u></p> <p>2.1 Describe the microbial growth curve.</p> <p>2.2 List and explain the chemical factors that affect microbial growth viz:</p> <ul style="list-style-type: none"> (i) nutrient (ii) Ph (iii) redoxpotential (iv) antimicrobial agents <p>2.3 List and explain the physical factors that affect microbial growth viz:</p> <ul style="list-style-type: none"> (i) temperature (ii) water activity (iii) relative humidity (iv) biological structure <p>2.4 List and explain the biotic factors that affect microbial growth viz:</p> <ul style="list-style-type: none"> (i) growth rate (ii) metabiosis (iii) antagonisms 	<p>Explain with diagram of microbial growth curve and give examples</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Diagrams</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>

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Week	General Objectives:3.0 KNOW THE TECHNIQUES FOR THE STUDY OF MICRO-ORGANISMS IN FOOD		
	Special Learning Objectives	Teachers Activities	Resources
7 - 9	<p style="text-align: center;"><u>Techniques for study of microorganisms in food</u></p> <p>3.1 Sample food for culturing on growth media.</p> <p>3.2 Select incubation conditions.</p> <p>3.3 Choose the medium for culturing.</p> <p>3.4 Culture and incubate microorganisms.</p> <p>3.5 Describe the cultural characteristics of microbial colonies (size, shape, etc).</p> <p>3.6 Isolate pure cultures.</p> <p>3.7 Test for gram reactions.</p> <p>3.8 Stain to identify spores, flagella, capsules.</p> <p>3.9 Identify bacterial structures under the oil immersion lens.</p>	<p>Practical – Sample food for culturing on growth media.</p> <p>Practical – Select incubation condition.</p> <p>Practical-Choose the medium for culturing, culture and incubate microorganisms.</p> <p>Describe the cultural characteristics of microbial colonies</p> <p>Practical-Isolate pure cultures.</p> <p>Practical: carry out the gram stain. Draw from the microscope.</p> <p>Identify for students.</p>	<p>Sterile sampling bottles; Incubator;</p> <p>Sketch/drawings Description of cultural characteristics. Sketches/drawings of cultural characteristics.</p> <p>Stains, microscope.</p>

Week	General Objectives:4.0 UNDERSTAND THE MICROBIOLOGICAL SPOILAGE OF SPECIFIC FOODS		
	Special Learning Objectives	Teachers Activities	Resources
10 - 12	<p style="text-align: center;"><u>Microbiological spoilage of specific foods</u></p> <p>4.1 Identify in the laboratory bacteria associated with the spoilage of the following groups of food:</p> <ul style="list-style-type: none"> (a) meat and meat products; (b) poultry products (c) milk and dairy products; (d) fermented foods; (e) baked food and confectionery; (f) fruits and vegetables; (g) canned foods; (h) sea foods; (i) dehydrated foods; (j) cereals and cereal products; <p>4.2 Identify sources of contamination for each of the food groups in 4.1 above.</p> <p>4.3 Identify storage conditions for each of the food groups listed in 4.1 above to prevent contamination and spoilage.</p>	<p>Practical – Laboratory identification</p> <p>Conduct student to isolate the bacteria on culture;stain,view under the microscope and draw.</p>	<p>Sample bottles, incubators, autoclaves, microscope.</p>

Week	General Objectives KNOW INDICES OF FOOD SANITATION AND MICROBIOLOGICAL STANDARD AND CRITERIA		
	Special Learning Objectives	Teachers Activities	Resources
13 - 14	<u>Indices of food sanitation</u>		
	5.1 Describe problems encountered in direct examination of food by pathogens.	Isolate mesophytic mic	Teaching
	5.2 Explain mesophylic aerobes		
	5.3 Carry out total plate count for mesophylic aerobes.	Carry out total plate count.	Autoclave, incubator, agars.
	5.4 Explain limitations of plate as a test of contamination.		
	5.5 Explain E. coli as indicator of contamination. Carry out coliforms count with particular references to E. coli as a test of contamination.	Carry out coliform counts	“ “ “
	5.6 Explain limitations of coliforms test as a test of contamination.		
	5.7 Describe total enterobacteriaceae count.		
5.8 Describe pathogen as an index of food sanitation.			

Week	General Objectives KNOW DIFFERENT TYPES OF FOOD BORNE DISEASES		
	Special Learning Objectives	Teachers Activities	Resources
15	<p style="text-align: center;"><u>Food borne diseases</u></p> <p>6.1 List and describe symptoms of food infection caused by bacteria, protozoans, helminthes, viruses.</p> <p>6.2 Describe the methods of transmission of the organisms in 6.1 above.</p> <p>6.3 Investigate food infection and food poisoning in a given situation.</p>	<p>Lecture</p> <p>Lecture</p> <p>Practical – spoilt foods.</p>	<p>Teacher Classroom Blackboard Chalk</p> <p>Sample bottles, incubator, microscope</p>

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: BASIC HEAT TRANSFER AND FLUID MECHANICS		Course Code: FST 215	Contact Hours: (2-0-0)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	1.0 Understand the concept of heat transfer and its relevance in the food industry.		
	2.0 Understand forms and modes of heat transfer.		
	3.0 Understand methods of determining heat transfer rates.		
	4.0 Understand the application of heat transfer to food processing.		
	5.0 Understand the concept of fluid mechanics.		
	6.0 Understand the basic classification of fluids.		
	7.0 Understand the fluid moments and energy balance in fluids flows.		
	8.0 Understand basic energy requirements for fluid flows.		

Week	General Objectives UNDERSTAND THE CONCEPT OF HEAT TRANSFER AND ITS RELEVANCE IN THE FOOD INDUSTRY		
1 - 2	Special Learning Objective:	Teachers Activities	Resources
	<u>Concept of Heat Transfer</u> 1.1 Define heat, heat transfer, temperature. 1.2 State and define types of heat i.e. latent heat, sensible heat. 1.3 List and state the importance of heat application in the food industry. 1.4 Heat and water cool	Teaching “ “ Conduct practical by teacher	Teacher Classroom Blackboard Chalk Laboratory (workshop) Practical
3	General Objectives UNDERSTAND FORMS AND MODES OF HEAT TRANSFER		
	<u>Forma and mode of heat transfer</u> 2.1 Explain the various modes of heat transfer viz, conduction, convection and thermal radiation. 2.2 Describe the application of the modes in 2.1 above in food heating. 2.3 Explain the mechanism of heat transfer by each mode in 2.1 above. 2.4 Explain the terms steady state and unsteady state heat transfer.	Teaching “ “	Teacher “ “

Week	General Objectives UNDERSTAND METHODS OF DETERMINING HEAT TRANSFER RATES		
	Special Learning Objective:	Teachers Activities	Resources
4 - 5	<u>Determine heat transfer rates</u>		
	3.1 State the Fourieis equations for heat transfer as applied to various simple geometries: slabs in finite cylinders and planes.	Teaching	Teacher
	3.2 Explain the concept of thermal resistance to heat transfer.	Teaching	“
	3.3 List the thermal conductivity of food and food packaging materials and insulators.	“	“
	3.4 State the Newton’s cooling equations.	“	“
	3.5 Apply 3.4 above to convective heating, calculating convective heat transfer coefficient in planes, cylinders.	Teaching	“
	3.6 Explain the Stefan-Boltzman’s equation for radiative heating viz: in Black bodies, Grey bodies etc.	“	“
	3.7 Solve simple heat transfer problems using the equations listed in 3.1, 3.4 and 3.6 above.	“	“
3.8 Solve simple heat transfer problems involving the three modes of heat transfer.			

Week	General Objectives UNDERSTAND THE APPLICATION OF HEAT TRANSFER TO FOOD PROCESSING		
	Special Learning Objective:	Teachers Activities	Resources
6 - 7	<u>Heat transfer</u>		
	4.1 Define heat exchangers.	Teaching	Teacher
	4.2 Identify and describe common heat exchangers.	“	“
	4.3 Describe the application of heat transfer to foods in: <ul style="list-style-type: none"> - in cooling of foods - in heating of foods - in baking process - in pasteurization - in sterilization 	“	“
4.4 Identify common Heating/Cooling equipment in food industries.	“	“	

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Week	General Objectives UNDERSTAND BASIC ENERGY REQUIREMENTS FOR FLUID FLOWS		
	Special Learning Objective:	Teachers Activities	Resources
14 - 15	<u>Energy requirements for fluid flows</u>		
	8.1 Explain the process of fluid flow through round pipes.	Lecture	Teacher
	8.2 Explain the concept of conservation of energy in fluid flows.	Lecture	“
	8.3 Derive the Bernouilli’s equation.	“	“
	8.4 Determine energy of fluids in pipes using the equation in 8.3 above.	“	“
	8.5 List and explain the sources of energy losses in fluids during fluid flows.	“	“

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: PROCESSING AND PRESERVATION OF PLANT FOOD PRODUCTS		Course Code: FST 216	Contact Hours: (2-0-3)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>1.0 Understand methods and principles of fruit and vegetable processing and preservation.</p> <p>2.0 Understand the principles and techniques involved in root and tuber processing and preservation.</p> <p>3.0 Understand the principles and techniques involved in cocoa, coffee and tea products manufacture.</p> <p>4.0 Understand the principles and techniques involved in the processing of cereals and legumes.</p>		

Week	General Objectives UNDERSTAND METHODS AND PRINCIPLES OF FRUIT AND VEGETABLE PROCESSING AND PRESERVATION		
	Special Learning Objective:	Teachers Activities	Resources
1 - 4	<u>Fruit and vegetable processing and preservation</u>		
	1.1 Identify various classes of fruits and vegetables and distinguish between them.	Lecture	Teaching Tools
	1.2 Describe types of spoilage associated with fruits and vegetables.	“	“
	1.3 Describe the various unit operations involved in the processing of fruits and vegetables.	“	“
	1.4 Produce and package banana and other fruit chips and flakes.	Practical – production of packaged banana chips and flakes.	Deep frier, Drier.
	1.5 Brew wine using local fruits.	Practical-production of wine from local fruits.	Juice Expeller, Fermenter.
	1.6 Produce and package jam using local fruits.	Practical-production of jam from local fruits.	Pan evaporator.
	1.7 Preserve local fruits and vegetables applying low temperature, local packaging methods and fermentation techniques.	Practical-preservation of local fruits using different techniques.	Refrigeration unit (i.e. chiller and freezer)
	1.8 Produce by grinding, cutting etc. package and preserve local spices e.g. pepper.	Practical	Hammer/Disc mill Sieves.
1.9 Produce by grinding, milling etc. packaged and preserved various local seeds and vegetables e.g. egusi.	Practical	Hammer/Disc mill	

Week	General Objectives UNDERSTAND THE PRINCIPLES AND TECHNIQUES INVOLVED IN ROOT AND TUBER PROCESSING AND PRESERVATION		
	Special Learning Objective:	Teachers Activities	Resources
5 - 8	<u>Root and tuber processing and preservation</u>		
	2.1 Define roots and tubers and distinguish between them.	Lecture	Teacher
	2.2 Identify local examples of roots and tubers (yam, cocoyam, potato, cassava)	Lecture	“
	2.3 Describe types of spoilage associated with roots and tubers.	“	“
	2.4 Describe different preservative methods by which storage life of roots and tubers can be whole prolonged.	“	“
	2.5 Explain unit operations involved in the processing of roots and tubers.	“	“
	2.6 Produce and package flour from yam, cassava and other local roots and tubers.	Practical workshop	Hammer/Disc attrition mill
2.7 Produce and package chips and flakes from potato etc.	Practical workshop	Slicer, Drier	

Week	General Objectives UNDERSTAND THE PRINCIPLES AND TECHNIQUE INVOLVED IN COCOA, COFFEE AND TEA PRODUCT MANUFACTURE		
	Special Learning Objective:	Teachers Activities	Resources
9 - 11	<u>Cocoa, Coffee and Tea Product manufacture</u>		
	3.1 Explain the nature and characteristics of cocoa, coffee and tea.	Lecture	Teaching Tools
	3.2 Describe the stages involved in coffee and cocoa products production.	Lecture	“
	3.3 Explain the steps involved in tea production.	“	“
	3.4 Produce powdered beverage from cocoa.	Practical production of powdered beverage from cocoa	Mill, Sieves, roaster/oven
	3.5 Process coffee into a powdered beverage product.	Production of powdered beverage from coffee	Hammer mill, Roaster/oven
3.6 Describe types of deterioration associated with cocoa, coffee and tea and their products.	Lectures	Teaching Tools	

General Objectives UNDERSTAND THE PRINCIPLES AND TECHNIQUES INVOLVED IN THE PROCESSING OF CEREALS AND LEGUMES			
12 – 15	<u>Processing of cereals and legumes</u>		
	4.1 Identify major cereals and legumes with special reference to local examples.	Practical identification	Various cereals and legumes
	4.2 Describe structural components and chemical composition of cereal and legumes their national significance.	“	“
	4.3 Describe types of spoilage associated with cereals, legumes and their products	“	“
	4.4 Describe the unit operations involved in cereal and legume processing (modern and traditional).	“	“

Week	General Objectives UNDERSTAND THE PRINCIPLES AND TECHNIQUES INVOLVED IN THE PROCESSING OF CEREALS AND LEGUMES		
	Special Learning Objective:	Teachers Activities	Resources
	4.5 Describe various methods applied in cereals and grain legumes preservation.	Practical identification	Teacher
	4.6 Describe the technique of bread and biscuit production.	“	“
	4.7 Produce flour from local cereals and legumes.	Practical	Roller mill, Attrition mill
	4.8 Produce bread and biscuits from flour extracted from cereals.	“	Bakery oven, mixer, kneader
	4.9 Describe the various types of deterioration of baked goods.	Lecture	Teaching Tool
	4.10 Extract and purify oil from Groundnuts and Soya bean. Compare the oils.	Practical	Oil extractor/Expeller
	4.11 Compare the oils in 4.10 above.	“	
	4.12 Prepare and package groundnuts and groundnut cakes.	“	Heat sealer, Roaster, Sheller.

PROGRAMME: FOOD TECHNOLOGY NATIONAL DIPLOMA
COURSE: FOOD QUALITY CONTROL (STATISTICS)
CODE: FST 221
DURATION: (Hours/Week) Lecture 1 Tutorial 0 Practical 0
UNIT: 1.0
GOAL: This course is designed to introduce standard to statistical concept in quality control.

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: FOOD QUALITY CONTROL (STATISTICS)		Course Code: FST 221	Contact Hours: (1-0-0)
Course Specification: LECTURE AND PRACTICAL			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	1.0 Principles, scope, organization and techniques of Quality Control and assurance. 2.0 Understand statistical methods in Quality Control and Quality assurance. 3.0 Understand the procedures for sensory evaluation of foods.		

Week	General Objectives PRINCIPLES, SCOPE, ORGANISATION AND TECHNIQUES OF QUALITY CONTROL AND ASSURANCE		
	Special Learning Objective:	Teachers Activities	Resources
1 - 5	<u>Scope of Quality Control and Assurance</u>		
	1.1 Define quality control, quality assurance and total quality management.	Lecture	Teaching Tools
	1.2 Explain the relationship between quality control, quality assurance and total quality management.	“	“
	1.3 Identify types of quality characteristics, namely variables and attributes.	“	“
	1.4 Explain the reasons for good quality in processed foods and responsibility for quality control and assurance.	“	“
	1.5 Explain the uses of quality control.	“	“
	1.6 Explain standards for finished product.	“	“
	1.7 Describe storage and distribution conditions that influence quality.	“	“

Week	General Objectives UNDERSTAND STATISTICAL METHODS IN QUALITY CONTROL AND QUALITY ASSURANCE		
	Special Learning Objective:	Teachers Activities	Resources
6 - 10	<u>Statistical methods in quality control</u>		
	2.1 Explain statistical quality control.	Lecture	Teaching Tools
	2.2 Calculate mean, median, mode and statistical deviation of data.	Lecture	“
	2.3 Construct frequency distribution table, histogram and distribution curve for data.	“	“
	2.4 Explain the relationship between mean, mode and median of data.	“	“
	2.5 Calculate and construct simple variable and attribute control charts.	“	“
	General Objectives UNDERSTAND THE PROCEDURES FOR SENSORY EVALUATION OF FOODS		

11 – 15	<u>Sensory evaluation of food</u>	Lecture “ “ “ “	Teaching Tools “ “ “ “
	3.1 Identify sensory parameters of foods.		
	3.2 List the role of human sensory organs in sensory evaluation.		
	3.3 Identify the procedures for sample preparation during sensory evaluation.		
	3.4 Identify criteria for choosing taste panel members.		
	3.5 Explain the appropriate procedures for sample preparation during sensory evaluation.		

Week	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	3.6 Explain the principles of the common tests used in sensory evaluation: <ul style="list-style-type: none"> (a) Triaght test (b) Duo-trio test (c) Scoring test (d) Multiple comparison test 3.7 Analyse and interpret results of the tests listed in 3.6 above. 3.8 Estimate significant differences in food quality. 3.9 Conduct simple sensory evaluation of food product and interpret the results statistically.	Lecture “ “ Organise and participate in taste panel evaluation of foods	Teaching Tools “ “ Taste panel room

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: ENGINEERING MATERIALS IN FOOD SYSTEMS		Course Code: FST 222	Contact Hours: (1-0-1)
Course Specification: THEORY			
WEEK	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	<p>1.0 Understand properties of engineering materials used in the food industry.</p> <p>2.0 Know possible defects in metals used in food industry.</p> <p>3.0 Know the properties of metals and alloys and their uses in food industry.</p> <p>4.0 Know the problems of corrosion in the process industry.</p> <p>5.0 Know the properties and application of non- metallic materials in the food industry.</p> <p>6.0 Know the properties and use of glass in the food industry.</p>		

Week	General Objectives UNDERSTAND PROPERTIES OF ENGINEERING MATERIALS USED IN THE FOOD INDUSTRY		
1 - 5	Special Learning Objective:	Teachers Activities	Resources
	<u>Properties of engineering materials in the food industry</u>		
	1.1 Describe the types and nature of different chemical bonds.	Lecture	Teaching Tools
	1.2 Distinguish between crystal of metals and crystals of compounds and amorphous substances.	“	“
	1.3 Define elastic, shear and bulk moduli.	“	“
	1.4 State and explain the equations governing 1.3 above.	“	“
	1.5 Define Poisson’s Ratio and state the relationship of three properties in 1.3 above.	“	“
	1.6 Explain the relationship between Young’s Modulus and linear coefficient of expansion	“	“
	1.7 Explain the significance of Young’s modulus of elasticity to food processing.	“	“
	1.8 Determine experimentally Young’s modulus of elasticity of a food item.	Practical conduct	Young’s modulud
1.9 Explain the consequences of non-uniform expansion or contraction on metallic and non-metallic substances.	“	“	

Week	General Objectives KNOW POSSIBLE DEFECTS IN METALS USED IN FOOD INDUSTRY		
6 - 8	Special Learning Objective: DEFECTS IN METALS	Teachers Activities	Resources
	<u>Metal defects in Food Industry</u>		
	2.1 Explain the causes of defects in metals.	Lecture	Teaching Tools
	2.2 Explain the occurrence of the following point defects: - vacancy interstitial, displacement (ferkel) and Schotty imperfections.	“	“
	2.3 Explain the meaning of a dislocation or linear imperfection.	“	“
2.4 Explain the occurrence of dislocations e.g. edge dislocation etc.	“	“	
9 – 10	General Objectives KNOW THE PROPERTIES OF METALS AND ALLOYS AND THEIR USES IN FOOD INDUSTRY		
	Special Learning Objective:	Teachers Activities	Resources
	<u>Metals and alloys in Food Industry</u>		
	3.1 Identify the different types of metals and alloys used in the food industry.	Lecture	Teaching Tools
	3.2 Describe the general composition and properties of the following: (i) Iron and stainless steel (ii) Copper and copper alloys (iii) Aluminium and aluminium alloys (iv) Nickel and nickel alloys	“	“
3.3 Explain the use of protective coatings for metal used in food processing e.g. zinc,aluminium, chromium etc.	“	“	

Week	General Objectives KNOW THE PROBLEMS OF CORROSION IN THE PROCESS INDUSTRY		
11 - 12	Special Learning Objective:	Teachers Activities	Resources
	<u>CORROSION IN THE PROCESS INDUSTRY</u>		
	4.1 Define Corrosion	Lecture	Teaching Tools
	4.2 Identify various types of corrosion.	“	“
	4.3 Explain the nature of various metallic corrosion and their causes.	“	“
	4.4 Describe the different methods of protection against corrosion.	“	“
4.5 Explain the effect of high temperature on metals.	“	“	
4.6			
13 – 14	General Objectives KNOW THE PROPERTIES AND APPLICATION OF NON-METALLIC MATERIALS IN THE FOOD INDUSTRY		
	Special Learning Objective:	Teachers Activities	Resources
	<u>NON-METALLIC MATERIALS IN FOOD INDUSTRY</u>		
	5.1 Describe the different structures of polymers.	Lecture	Teaching Tools
	5.2 Classify polymers according to their thermoplastic properties.	“	“
	5.3 List polymeric materials and their applications in the food industry.	“	“
5.4 Describe the use of polymeric materials in composite packages.	“	“	
5.5 List the advantages of using polymeric materials for coating.	“	“	

Week	General Objectives KNOW THE PROPERTIES AND USE OF GLASS IN THE FOOD INDUSTRY		
15	Special Learning Objective: PROPERTIES AND USE OF GLASS IN FOOD INDUSTRY	Teachers Activities	Resources
	6.1 Describe the composition, chemical resistance and properties of different types of glass.	Lecture	Teaching Tools
	6.2 Describe the manufacture of glass.	“	“
	6.3 State the specific uses of types of glass in 6.1 above.	“	“
	6.4 Describe the various coating applied to glass for reinforcement.	“	“

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: INTRODUCTION TO FOOD PACKAGING		Course Code: FST 223	Contact Hours: 1 – 0 - 0
Course Specification: THEORY			
Week	General Objectives		
	Special Learning Objective:	Teachers Activities	Resources
	1.0 Know the nature of packaging. 2.0 Understand the functions of food packaging materials.		

Week	General Objectives KNOW THE NATURE OF PACKAGING		
	Special Learning Objective:	Teachers Activities	Resources
1 - 8	<u>Nature of packaging</u>		
	1.1 Explain the term packaging.	Lecture	Teaching Tools
	1.2 Outline the scope of Food packaging.	“	“
	1.3 Outline the history of Food history.	“	“
	1.4 List reasons for packaging of Food.		
	1.5 Identify food-packaging materials used in Nigeria.	Workshop identification	“
	1.6 Identify the types of packaging materials, rigid, semi-rigid, and flexible used in industrial food packaging.	Workshop identification	“
	1.7 Describe the properties of the packaging material in 1.6 above.	Lecture	“
	1.8 State the criteria for choosing particular packaging materials for particular type of food.	“	“
1.9 List various food-packaging materials used for local food packaging in Nigeria.	“	“	
	“	“	

Week	General Objectives UNDERSTAND THE FUNCTIONS OF FOOD PACKAGING MATERIALS		
	Special Learning Objective:	Teachers Activities	Resources
9 - 15	<u>Functions of food packaging materials</u>		
	2.1 List attributes of packaging in the food industry.	Lecture	Teaching Tools
	2.2 Explain the primary packaging functions: e.g. physical protection of the food.	“	“
	2.3 Explain the use of packaging to extend the shelf life of foods e.g. through control of oxygen and water diffusion.	“	“
	2.4 Explain the importance of convenience packaging and list examples of such package foods.	“	“
	2.5 Explain the use of packaging as marketing tool.	“	“
	2.6 Describe with examples packaging as a means of product identity by consumers.	“	“
	2.7 Explain packaging as a useful information tool e.g. provision of nutritional information and directions for product reconstitution.	“	“
2.8 Describe the techniques of can fabrication including materials for construction, can testing and seaming.	“	“	

PROGRAMME: NATIONAL DIPLOMA IN FOOD TECHNOLOGY			
Course: PROCESSING AND PRESERVATION OF ANIMAL FOOD PRODUCTS		Course Code: FST 224	Contact Hours: 1 – 0 - 3
Course Specification: THEORY AND PRACTICAL			
Week	General Objectives UNDERSTAND THE TECHNIQUES EMPLOYED IN THE PRESERVATION AND PROCESSING OF MILK AND DAIRY PRODUCT		
	Special Learning Objective:	Teachers Activities	Resources
	1.0 Understand the techniques employed in the preservation and processing of milk and dairy products.		
	2.0 Understand the techniques employed in the preservation and processing of meat and meat products.		
	3.0 Understand the techniques employed in the preservation and processing of fish and fish products.		
	4.0 Understand the techniques employed in the preservation and processing of poultry products.		

Week	General Objectives UNDERSTAND THE TECHNIQUES EMPLOYED IN THE PRESERVATION AND PROCESSING OF MILK AND DAIRY PRODUCT		
	Special Learning Objective:	Teachers Activities	Resources
1 - 3	<u>Preservation and processing of milk and dairy products</u>		
	1.1 Identify the different types of Dairy products.	Practical identification	
	1.2 Describe the techniques involved in handling of raw milk and its products (e.g. butter, cheese).	Lecture	Teaching Tools
	1.3 Describe the processing and preservation of milk and its products e.g. butter, cheese.	“	“
	1.4 Produce and package butter and cheese from raw milk.	Practical: production of butter from raw milk.	Dairy processing line/milk churn
1.5 Produce and package dry milk using spray drier and plastic film packaging.	Practical: production of spray dried milk powder	Spray drier	

Week	General Objectives UNDERSTAND THE TECHNIQUES EMPLOYED IN THE PRESERVATION AND PROCESSING OF MEAT AND MEAT PRODUCTS		
	Special Learning Objective:	Teachers Activities	Resources
4 – 7	<u>Preservation and processing of meat and meat products</u>		
	2.1 Identify types of meat products.	Lecture	Teaching Tools
	2.2 Describe the general composition and structure of meat.	“	“
	2.3 Explain the significance of rigor mortis in meat processing.	“	“
	2.4 List and describe the various methods of processing and preserving meat (e.g. refrigeration, canning, curing/salting etc.).	“	“
	2.5 Produce dried meat packaged in plastic bags etc.	Practical: production of packaged dry meat.	Drier, heat sealer.
	2.6 Produce cured meat packaged in plastic bags.	Practical: production of package cured meat packaged in plastic bags	Drier, heat sealer
2.7 Produce comminuted meat product e.g. sausage, minced meat.	Practical: production of sausage and other comminuted products	Meat mincer	

Week	General Objectives UNDERSTAND THE TECHNIQUES EMPLOYED IN THE PRESERVATION AND PROCESSING OF FISH AND FISH PRODUCTS		
8 – 11	Special Learning Objective:	Teachers Activities	Resources
	Preservation and processing of meat and fish		
	3.1 Identify types of fish product.	Lecture	Teaching Tools
	3.2 Describe the general composition and structure of fish.	“	“
	3.3 Explain the nature of lipids in fish.	“	“
	3.4 List and describe the various methods of processing and preserving fish (e.g. smoking, salting, drying, freezing etc.).	“	“
	3.5 Produce packaged smoked fish.	Practical: production of packaged smoked fish	Smoking kiln
	3.6 Produce frozen packaged filleted fish.	Practical: production of frozen fish.	Blast freezer/Plate freezer
	3.7 Produce fishmeal product.	Practical: production of fish meal	Solvent extractor/Oil expeller, Drier

Week	General Objectives UNDERSTAND THE TECHNIQUES EMPLOYED IN THE PRESERVATION AND PROCESSING OF POULTRY PRODUCTS		
	Special Learning Objective:	Teachers Activities	Resources
12 – 15	<u>Processing and preservation of poultry products</u>		
	4.1 Identify various sources of poultry meat (e.g. chicken, turkey, ducks, geese etc).	Lecture	Teaching Tools
	4.2 Explain the edible portions of poultry meat.	“	“
	4.3 Describe the compositions of different poultry meat.	“	“
	4.4 List and describe the various stages in production of dressed poultry bird (e.g chicken).	“	“
4.5 Prepare different poultry parts packages for market.	Practical: production and identification of different poultry parts in packaged form.	Blast freezer.	