NATIONAL BOARD FOR TECHNCIAL EDUCATION
KADUNA

HIGHER NATIONAL DIPLOMA

IN

BIOCHEMISTRY

CURRICULUM AND COURSE SPECIFICATIONS

2003

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

HIGHER NATIONAL DIPLOMA IN BIOCHEMISTRY

GENERAL INFORMATION

PROGRAMME GOAL:
This programme is designed to produce biochemical technologist capable of applying laboratory techniques to complement the work of scientist in industrial and laboratory biochemical analysis and production processes.

PROGRAMME OBJECTIVES:
A diplomate of this programme should be able to:
Carry out biochemical analysis in laboratories in education, food and chemical industries and in research institutes.

STRUCTURE OF THE PROGRAMME:

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.

HIGHER NATIONAL DIPLOMA
The Higher National Diploma Biochemistry programme is terminal and is structured to last for two years (four Semester). This incorporates four to six months of supervised industrial attachment.

CURRICULUM
Curriculum of all programmes consists of four main components. These are:

i. General studies/Education
ii. Foundation courses
iii. Professional courses
iv. Student Industrial Work Experience scheme (SIWES).

The General Education component shall include courses in Art and Humanities- English Language, Communication, History. These are compulsory.

Mathematics and Sciences (for non-science based programmes)
Social studies-Citizenship (the Nigerian Constitution) political science, Sociology, Philosophy, Geography, Entrepreneurship
Physical and Health Education (one semester credit only).
Foundation Courses include courses in Economics, Mathematics, Pure Sciences, Technical drawing, descriptive geometry, Statistics, e.t.c. The number of hours will vary with the programme and may account for about 10-15% of total contact hours. Professional courses are courses which give the student the theory and practical skills he needs to practice his field of calling at the theory and practical skills he needs to practice his field of calling at the technician /technologist level. These may account for between 60-70% of the contact hours depending on programme.
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 de tails of SIWES in Guideline on SIWES at page 5.

CURRICULUM STRUCTURE

ND Programme
The structure of the ND Programme consists of four semesters of classroom, laboratory and workshop activities in the college–and a semester (3-4 months) of supervised industrial work experience scheme (SIWES). Each Semester shall be of 17 weeks duration made up as follows:
15 contact weeks of teaching, i.e. recitation, practical exercises, quizzes, test e.t.c; and a 2 weeks SIWES shall take place at the end of the second semester of the first year.

HND Programme
The Higher National Diploma Biochemistry programme is a terminal programme and is structured to last for two years (four semesters). This incorporates four to six months of student industrial attachment.

ACCREDITATION:
Each programme offered either at the ND or HND level shall be accredited by NBTE before the diplomates can be awarded either of the two diploma certificate. Details about the process of accreditation a programme for the award of the ND or HND are available for the executive secretary, Programmes Division, National Board for Technical Education, Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria.

CONDITIONS FOR THE AWARD OF THE ND/HND

Institutions offering accredited programmes will award the Nation 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. Diplomates shall be classified as follows:

Distinction - GPA of 3.50 and above
Upper Credit -GPA of 3.00 - 3.49
Lower Credit -GPA of 2.50 – 2.49
Pass - GPA of 2.00 – 2.49
Fail - GPA of below 2.0

EVALUATION OF AWARD:

All terminals National Diploma and Higher National Diploma examinations must be externally moderated in grading the award, the Board's unified Grading system should be applied.

GUIDANCE NOTE 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 stress the need to introduce the semester credit which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.

In designing the units the principle of the modular system by product has been adopted; thus making each of the professional modules, when completed provides the student with technician operative skills, which can be use d for employment purposes.

As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has being 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 diplomates 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 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 institution under which the performance can take place and to follow that which the criteria for determining an acceptable levels of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution.

Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered through the polytechnic system.

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

GUIDANCE FOR THE SIWES PROGRAMME

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

Responsibility for Placement of Students

Institutions offering the ND programme shall arrange to place the students in industry. By April 30 of each year, six copies of the master list showing where each student has being placed shall be submitted to the executive secretary, NBTE which shall, in return, authenticate the list and forward it to the industrial Training Fund Jos.

The Placement Officer should discuss and agree with industry on the following:

i. A task inventory of what the students should be expected to experience during the period of attachment. It may be wise to adopt the one already approved for each field.
ii. The industry-based supervisor of the student during the period likewise the institution based supervisor.
iii. 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.

Evaluation of Students during the SIWES

In the evaluation of students, 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.

GRADING OF SIWES

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

THE INSTITUTION BASED SUPERVISOR

The institution based supervisor should initiate the log book 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.

FREQUENCY OF VISIT

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

There is another visit six weeks after the first visits; and

A final visit in the last month of the attachment.

STIPEND FOR STUDENTSS 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.

SIWES as a Component of the Curriculum

The completion of SIWES is important in the final determination of whether the student 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.

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
COM 301	Computer Application	1	-	2	2.0	30	
STH 311	Biochemical Methods I	2	-	2	3.0	65	
STH 312	Physical Biochemistry I	1	-	2	2.0	45	
STH 313	Microbial immunochemistry	2	-	2	3.0	60	
GLT 303	Biological and Chemical Instrumentation	2	-	3	3.0	75	
GLT 301	Laboratory Management	2	-	-	2.0	30	
GNS 301	Use of English	2	-	-	2.0	30	
		12	-	14	18	375	

GLT Course see General Laboratory Techniques syllabus
GNS Course see General Studies syllabuses
STH 424 See Page 68 in Science Lab. Technology syllabus

HND BIOCHEMISTRY
1ST YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
STA 305	Biometrics	2	-	2	3.0	60	
STH 321	Biochemical Method II	2	-	3	3.0	75	
STH 322	Intermediary Metabolism I	2	-	2	3.0	60	
STH 323	Regulation of Cell Metabolism	1	-	2	3.0	60	
STH 324	Nutritional Biochemistry II	1	-	3	2.0	60	
STH 325	Physical Biochemistry II	2	-	2	2.0	45	
GLT 302	Instrumentation (General)	2	-	2	3.0	60	
GNS 302	Communication in English	2	-	2	2.0	30	
		12	-	12	21	450	

HND BIOCHEMISTRY
2ND YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
STH 411	Intermediary Metabolism II	1	-	2	2.0	30	
STH 412	Nutritional Biochemistry II	1	-	3	2.0	60	
EDP 413	Entrepreneurship Development	2	-	-	2.0	30	
STH 413	Biotechnology and Genetic Engineering	2	-	2	3.0	60	
STH 414	Seminar	-	1	2	2.0	30	
GNS 401	Literacy Appreciation and Oral Composition	2	-	6	2.0	90	
		8	1	15	11	300	

HND BIOCHEMISTRY
2ND YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
STH 421	Tissue Biochemistry	2	-	2	3.0	60	
STH 422	Forensic Biochemistry	1	-	2	2.0	45	
STH 423	Industrial Biochemistry	2	-	3	3.0	60	
STH 424	Comparative Biochemistry	2	-	2	3.0	60	
STH 425	Seminar	-	-	-	1.0	-	
STH 426	Project	-	-	-	4.0	-	
		7	-	9	20.0	225	

PROGRAMME: BIOCHEMISTRY (HND)
COURSE: BIOCHEMICAL METHOD I
CODE: STH 311
DURATION: 60Hours, 15weeks, (2Hours Lecture, Tutorials 0.2 Hours Practicals
UNIT: 3.0
GOAL: This course is designed to enable the diplomate carry out various analytical method in Biochemistry.

GENERAL OBJECTIVES:

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

1.0 know the general principles of biochemical investigation.
2.0 Know the various principles and application of configuration.
3.0 Understand the principle and application of dialysis.
4.0 Understand the principle and application of manometric techniques.
5.0 Understand the principle and application of polarimetry.
6.0 Understand the principle of refractometry techniques.

PROGRAMME: HND BIOCHEMISTRY			
Course: BIOCHEMICAL METHODS I	**Course Code:** STH 311	**Contact Hours** 60 Hrs 2-0-2	
Course Goal: This course is designed to enable the student carry out various analytical method in biochemistry			
WEEK	**General Objectives** 1.0 Know the general Principles of biochemical investigation		
	Special Learning Objective:	**Teaching Activities**	**Resources**
1-2	Explain the fundamental concepts and approaches which has to be considered when designing biochemical experiments.	Lectures	High speed centrifuge
	Describe the methods for isolation of particles or organelles inside a cell .	Laboratory experiment in cell isolation	"
	Organelle/particle components are separated from each other by various separation techniques.	"	"
	Extract various organelles from the cell by centrifugation technique.	Laboratory practical in centrifugation of the cell	"
	Describe the qualitative and quantitative analytical techniques that are employed in the determination of the components of the cell.	Lecture	Teaching tools
	Describe the Spectroscopic techniques which are available for the study of the components at atomic or molecular level.	Lecture	"
	Describe the various combination of analytical techniques available for the elucidation of the mode of action and inter-relationships of components within particles and cells.	Lecture	"

	General Objectives : 2.0 Know the various principle and application of centrifugation.		
WEEK	**Special Learning Objective:**	**Teachers Activities**	**Resources**
3-5	2.1 Define Centrifugation	Lecture	Teaching tools
	2.2 Describe the various principles Of Centrifugation	"	"
	2.3 Explain the applications of centrifugation as a Separation techniques.		
	2.4 List the parameters which determine the Sedimentation rate (inversely related to time taken).	"	"
	2.5 . List the parameters which determine the successful separation of mixture of heterogenous particles.		
	2.6 Explain the importance of the density and viscosity of the medium in facilitating the separation.		"
	2.7 List the order of sedimentation of the major cell components.	"	
	2.8 Define preparative centrifugation and analytical centrifugation and state the difference(s) between the two.		"
	2.9 List the applications of preparative and analytical centrifugation.	"	
	2.10 List the three major classes of preparative centrifugation (general purpose centrifuge, higher speed centrifugation and the preparative ultracentrifuge) their rotor designs and uses).		
	2.11 Describe the different methods of preparative centrifugation viz:	"	"

	i) Differential centrifugation ii) Rate-Zonal centrifugation. iii) Isopyenic (equal-density) centrifugation iv) Equilibrum Isodentsity centrifugation 2.12. Identify the types of media for the preparation of liquid density gradients. 2.13. Explain the discontmous or layering density gradient techniques. 2.14. Explain the continuous density gradient techniques 2.15. Describe how gradients are removed from centrifuge tubes. 2.16. Carry out differential centrifugation and present the results. 2.17. Describe the basic principles of the analytical ultracentrifugation. 2.18. Apply analytical ultracentrifugation method in the l i)Determination of molecular weights ii) Estimation of purity of macromolecules. iii) Detection of conformational changes in macromolecules.		High speed centrifuge Ultracentrifuge

WEEK	**General Objectives** 3,0 Understand the Principle and Application of Dialysis		
	Special Learning Objective:	**Teachers Activities**	**Resources**
6-7	3.1 Explain the term "dialysis" 3.2 Describe the need for dialysis during protein purification. 3.3 Apply the process of dialysis/ultradialysis protein purification. 3.4 Explain the irritation of dialysis. 3.5 State the steps that can be taken to ensure successful dialysis of a protein solution. 3.6 List the applications of dialysis.	Lecture Laboratory Demonstrate the analysis experiment Lecture " "	
WEEK	**General Objectives** 4.0 Understand the Principles and Application of Manometric Techniques.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
8-9	4.1 Explain the term "Manometry" 4.2 4.2 Explain the principle and application of Manometric Technique. 4.3 Explain the Similarities and differences between Manometric and the oxygen electrode. 4.4 Define the terms Respiratory Quotent and Metabolic Quotent. 4.5 Explain the three types of Manometry viz: i) Constant volume Manometry. ii) Constant Pressure Manometry. iii) Differential Manometry. 4.6 Describe the operation, and principle and calibration of the Warburg constant volume Manometre. 4.7 Describe the Gilson Differential Respirometre. 4.8 List the general procedure for the operation of a Manometre. 4.9 List the application of manometry.	Show and describe the manometer to students " " " " Show and describe the respirometer to students "	Manometer " " " Respirometer "

WEEK	General Objectives 5.0 Understand the Principles and Applications of Polarimetry.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
10-12	5.1 Explain the term "plane polarized light" 5.2 List and identify the substances that produce plane-polarized light e.g Nicol Prism, tourmaline, ice/spa. 5.3 Explain the term "Optical activity". 5.4 List the substances possessing optical activity (e.g. simple sugars). 5.5 Distinguish between optically active compounds as dextro and laera rotaroty. 5.6 Explain the specific rotation of a compound. 5.7 Describe the components of a polarimetre; Light source, polarizer tube analyzer. 5.8 Describe the method of determination of specific rotation of a substance. 5.9 Calculate the concentration and specific rotation of a substance. 5.10Explain the limitation of a polarimeter in analytical work 5.11Determine the specific rotation of given simple sugars using polarimerer. 5.12Interpret the results obtained in 5.11 above. 5.13 Identify compounds tentatively using the result in 5.12 above.	Show and describe the polarimeter to students " " " Laboratory experiment of optical action compounds using polarimeter Lecture " " " Laboratory experiment of optical action compounds using polarimeter	Polarimeter " " " " " "

WEEK	General Objectives 6.0 Understand the principle of Refractometry techniques.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
13-14	6.1 Define "critical angle" and "refractive index" of a substance.	Show and describe the refractometer to students	Refractometer
	6.2 Describe the method of determining the refractive index of a substance.	"	"
	6.3 Describe a typical refractometre e.g abbe refractometre.	"	"
	6.4 Represent the refractometre diagrammatically.		
	6.5 Describe the operation of the refractometre.	"	
	6.6 List the applications of a refractometre in analytical work e.g. determination of the purity of a substance.	"	"
		"	Abbe retractometer
	6.7 Determine the refractive index of a solution wing Abbe refractiometer.	Students to determine refractive index	"
	6.8 State the limitations of the refractometre in analytical work.		Abbe retractometer
	6.9 Analyse a lipid using a refractometer.	Students to analyse lipids using refractometer	
		"	

PRACTICAL CONTENTS

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESKOURCES
1-2	1.4 Extract various organelles from the cell by centrifugation techniques	Guide students on laboratory experiment on various cell organs using centrifugation methods	High speed centrifuge sample of cell organ
	2.2 Identify the type of media for the preparation of liquid density graduates	Show students on how to identify liquid density gradients and its preparation in the laboratory.	High speed centrifuge cell sample
	2.6 Carry out different centrifugation and present the results	Carry out laboratory practical on different centrifuge with high speed.	High speed centrifuge
	2.18 Apply analytical ultracentrifugation in the determination of Molecular weights Estimation of purity of macromolecules Detection of conformation changes in macromolecules	Carry out laboratory ultracentrifugation to determine molecular weight of macromolecules.	Ultracentrifuge
	3.9 Prepare buffers for biochemical experiments	Guide students to prepare buffer for biochemical experiment	Salt and acid for buffer preparation

10-12	5.8 Analyse the method of determination of specific rotation of a substance 5.11 Determine the specific rotation of a given sample sugar using polarimeter. Interpret the results obtain in 5.11 Identify compounds tentatively using the result in 5.11 6.2 Analyse the method of determining the refraction index of a substance 6.7 Determine the refractive index of a solution using 6.9 Analyse a lipcal using a refractive meter	Carry laboratory experiment of optical compounds polarimeter. Carry compounds using polarimeter Guide students to determine the refractive index of any given substance Guide students to determine refractive index of a wing solution Guide students to analyse lip cal using refract meter	Polarimeter Pollarimeter Refract meter refractive pin Refract meter Abbe refmetometer

PROGRAMME: BIOCHEMISTRY (HND)
COURSE: PHYSICAL BIOCHEMICAL I
CODE: STH 312
DURATION: 45Hours/15Weeks/(1Hour Lectures,Tutorial 0, 2Hours Practicals)
UNIT: 2.0
GOAL: This course is designed to provide the student with a basic knowledge of physical biochemistry.

GENERAL OBJECTIVES:
1.0 Understand the properties of water,solutions and colloids
2.0 Understand the concepts of Acids Bases and Salts.
3.0 Understand the relevance pH and buffer system in biochemical reaction
4.0 Understand the Application of Acid –Base fluid and electrolyte control to some biochemical processes

PROGRAMM**E**: HND BIOCHEMISTRY			
Course: PHYSCIAL BIOCHEMICAL . I	**Course Code:** STH 312	**Contact Hours 45 Hours 1-0-2**	
Course Goals: This course is designed to provide the student with a basic knowledge of physical Biochemistry			
WEEK	**General Objectives** 1.0 Understand the properties of water, solutions and colloids		
	Special Learning Objective:	**Teaching Activities**	**Resources**

1 - 3	1.1 Describe the structure and properties of water e.g. SHC, Heat of vaporation., latent Heat etc. 1.2 Describe the electronic structure of water molecule and the implications of each property e.g. polarity hydrogen-bonding, surface tension. 1.3 Explain some proposed models for the structure of ice and liquid water. 1.4 Describe some physiochemical properties of water and how they are particularly suited to the role of water as the solvent of biological systems. 1.5 Demonstrate the solubility of water in comparism to other solvents like acetone benzene, alcohol, etc. 1.6 Explain surface tension it's 51 units of qualification. 1.7 Describe the phenomenon of surface tension and the biophysical implication of surface tension.	Lecture " " " Practicals Demonstration Lecture "	Chalkboard Practicals

WEEK	General Objectives		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	1.8 Determine surface tension by capillarity.	Lecture	Capillary tube
	1.9 Explain and compare the properties of solution, colloidal dispersed parties, suspension in terms of average diameter of dispersed particles, behaviour towards gravity and light filteravability, homogeneity and number of phases present	"	
	1.10Prepare different types of solutions	Practical preparation of solutions	Glasswares
	1.11Describe the different types of solutions and their common examples.		
	1.12Explain the quantitative expressions of concentration – molar concentration, concentrations expressed as percentage weight/volume; volume/volume, weight/weight milligram percentage part per million and parts per billion.	"	
	1.13Carry out calculations involving 1.9 above.		
	1.14 Prepare dilute solutions from more concentrated solutions.	"	Different types of salts, concentrate acids and bases.
	1.15Explain the colligative properties of non electrolyte solutions viz. Result's law and the lowering of vapour pressure.	Lectures	Glassware

WEEK	General Objectives		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
	(b) The relation between boiling point elevation and the molarity of the solution (c) Relation between freezing point depression and morality of a solution (d) Simple calculations based on (a) – (c) above and their applications (e) The phenomenon of osmotic pressure and the reaction between osmotic pressure and the molecular weight of solute. (f) The importance of osmotic phenomenon on biological system. 1.16 Determine the effects of 1.15 (b) (c) & (e) above on What? 1.17 Determine osmotic pressure of a solute 1.18 Explain the term Electrolyte solution and (i) Salting in and Salting out effects (ii) The Donnan Effect (iii) Dialysis (iv) Applications of (i) – (iii)	Lecture “ “	Practical – Osmotic pressure determination apparatus Practicals

WEEK	General Objectives 2.0 Understand the Concept of Acids, Bases and Salts		
4 - 5	**Special Learning Objective:**	**Teachers Activities**	**Resources**
	2.1 Understand the concepts of acids, bases and salts viz. Bronsted-lowry acids and bases , alkalis, ampholytes; strength of acids and bases. Hydrogenion concentration and pH: Definition of PH. (b) Derivation of KW (ionic product of water). (c) Temperature and Kw and its biological implication	Lecture	PH meter
	2.2 Measure pH using pH meter lovibond comparator	Carry out practicals on pH meter	PH meter
	2.3 Explain the principle of the pH meter: glass and Calomel electrodes.	"	
	2.4 Explain the theory and practice of pH of strong acids	"	
	2.5 Explain the concept of dissociation of Acids and bases viz. (a) Strong acids and calculation of pH of strong acids (b) Weak acids: the Henderson – Hasselbalch equation (c) Titraction curves: Strong acid/strong base; weak acid/strong base; tiraction curves of polyprotic acids.	"	Practical Burrette, pipette Beakers, Cornical flasks.
	2.6 Explain the common ion effect and its relationship to such biochemical phenomena as Urinary calculus, bile stones and gout.	Lecture	

WEEK	General Objectives 3.0 Understand the Relevance of pH and Buffer Systems in Biochemical Reactions		
	Special Learning Objective:	**Teachers Activities**	**Resources**
6 - 7	3.1 Explain the terms: (a) Buffering range of a very weak acid and (b) Buffering capacity	Lecture	Making of Teaching tools
	3.2 Explain the properties of cytoplasmic constituents (acidic, basic and amphoteric) e.g. Aminoacids, protein; heamoglobin etc.) which contribute to the buffering ability of cellular contents.	"	"
	3.3 Explain the importance of bicar bonate buffer $Hcoz^-$: H_2Co_3 in the buffer system of the entire organism.	"	"
	3.4 Explain the nature of the buffering systems in the blood (proteins, Heamoglobin, phosphate and bicarbonate).	"	"
	3.5 State the normal intracellular and extracellular fluid pH value of plants and animals (pH 7.4)	"	
	3.6 Explain why the pH of intracellular fluids differ widely on their values (gastric juice – 1.5; intestinal content – 6).	"	"
	3.7 Explain why attainment of an optical pH is essential for microbial function and growth		
	3.8 List types of buffer systems used in biochemical Work.		

WEEK	General Objectives		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	3.9 Prepare buffers for biochemical experiments 3.10 Calculate the pH of buffers 3.11 Determine the pH of colorless and colored fluid of biological origin using organic indicators and pH meter.	Practical “ “	Salts and acids for buffer preparation, glass ware pH meter “
WEEK	**General Objectives 4.0 Understand the Application of Acid-Base Fluid and Electrolyte control to some Biochemical Processes**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
8-9	4.1 Identify the metabolic products that can effect body fluid pH 4.2 Explain the role of blood buffers in pH control 4.3 Explain the respiratory control of blood pH via hypo and hyper – ventilation, and isohydric carriage of carbon dioxide 4.4 Explain the limitation of respiratory control of pH 4.5 Compare the rate and depth of pH compensation by respiratory control with those of renal control.	Lecture “ “ “ “	Teaching tools “ “ “ “

PRACTICAL CONTENTS

WEEK	PRACTICAL	TEACHERS ACTISITIES	RESOURCES
1-3	1.9 Analyse and compare the properties of solution colloidal dispersed particles, suspension of average diameter of dispersed particles behavior towards gravity and light tilteravability, homogeneity and number of phases present	Guide students on practical preparation of solutions	Glass wares
	1.10 Prepare different types of solutions	Guide students on practical preparation of defferent solutions -calculations	Glass wares
	1.13 Carry out calculations involving (1.9 above)	Prepare students to dilute solutions from more concentrated solutions	
	1.14 Prepare defuse solutions from more concentrated solutions	Guide students to determine different type of osmotic pressure of a solute salt diluted water, bases glass ware	
	1.19Determine osmotic pressure of a solute		
	2.3 Measure pH using pH meter lovibond comparator	Carry out practicals on pH meter	pH meter
6-7	Prepare buffers for biochemical experiments	Guide students to prepare buffer for biochemical experiments.	Salt and acid for buffer preparation
	3.11 Determine the pH of colorless and		Glass ware

	colored fluid of biological origin using organic indicator and pH meter	Carry out practicals to determine the pH of colorless and colored fluids of biological origin	Ph meter

PROGRAMME:	BIOCHEMISTRY (HND)
COURSE:	MICROBIAL IMMUNOCHEMISTRY
CODE:	STH 313
DURATION:	60 Hours/15Weeks (2Hours Lecture/Tutorial 0, 2Hours Practicals)
UNIT:	3.0
GOAL:	This course is designed to provide the student with a knowledge of the chemical Nature of microbial immune system
GENERAL OBJECTIVES:	On completion of this course,the student should be able to:

1.0 Understand the molecular structure of microorganism

2.0 Understand the general payments for microbial growth and various method of measuring microbial growth.

3.0 Understand the various source of Nitrogen,Carbon, and energy to microorganism and the effect of various concentrations of the different carbon sources on growth

4.0 Understand the nature of the immune system and compliment fixation.

5.0 Understand antigen- antibody and the significance of immunology on public health.

Course: MICROBIAL IMMUNOCHEMISTRY	**Course Code: STH 313**	**Contact Hours 60 hrs 2-0-2**
Goal: This course is designed to provide the students knowledge of the chemical nature of microbial immune systems		
WEEK	**General Objectives** 1.0 Understand the Molecular structure of microorganisms	
	Special Learning Objective:	**Teaching Activities**	**Resources**
	1.1 Explain the various methods of microbial cell disruption e.g. solid and liquid shear methods etc. 1.2 Explain the separation of the components of disrupted cells. 1.3 Describe the surface appendages of the bacterial cell e.g. flagella, capsule, etc. 1.4 Describe the cell wall components of gram negative and gram positive bacteria. 1.5 Carry out the following stemming techniques: gram stain, spore stain, flagella stain. 1.6 Describe the structure of cell membrane. 1.7 Describe the structure and components of cytoplasm.	Explain using some specific examples. Demonstrate experiment on cell separation techniques. Supervise individual gram staining of a bacteria etc. and grade reports. Use A/V facilities. Explain the component using film strides.	Microscope cell tissue. Microscope. Overhead projectors Microscopes.

WEEK	General Objectives 2.0 Understand the general requirements for microbial growth and the various methods of Measuring microbial growth.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
10 - 12	2.1 Explain the concept of microbial growth as being increase in population /cell, number/cell mass rather than increase in size or individual. 2.2 Describe the general requirements for microbial growth. 2.3 Describe the influence of environmental factors on growth of micro organisms. 2.4 Demonstrate the effects of some of the factor in 2.2 and 2.3 above on microbial growth. 2.5 Measure microbial growth directly. 2.6 Measuring microbial growth center. 2.7 Describe the microbial growth curve. 2.8 Explain the mathematics of microbial growth.	Demonstration using projectors. “ use examples such as slow growth under refrigeration. Laboratory Practical on growth of microbes. Practical on monitoring growth of Directly/indirectly. Drawings and overhead projector of microbial growth curve.	Audio visual facilities Microscopes Colony counters

WEEK	General Objectives:3.0 Understand the various sources of nitrogen, carbon and energy to microorganisms, and the effect of various concentrations of the different carbon sources on growth.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
13 - 14	3.1 Explain the importance of nitrogen sources in microbial growth. 3.2 List inorganic sources of nitrogen. 3.3 3.3 List organic sources of nitrogen. 3.4 Classify microorganisms according to mode of nitrogen (e.g. organotroph and litotroph). 3.5 Explain monosaccharides as sources of carbon and energy. 3.6 Explain oligosaccharides as sources of carbon and energy. 3.7 Explain polysaccharides as sources of carbon and energy. 3.8 Explain derivatives of the various carbohydrates as sources of carbon and energy. 3.9 Explain derivatives of the various carbohydrates as sources of carbon and energy.	Classroom lecture and demonstration. “ “ “ “ “ “ “ “ “ “	

WEEK	General Objectives 4.0 Understand the nature of the immune system and complement fixation.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
13-14	4.1 Outline the early concepts of immunology and public health.	Give examples.	
	4.2 Explain the terms antigen, antibody and other components of the immune system.	Lectures	
	4.3 Explain the structure and synthesis of antibodies.	Lectures.	
	4.4 Explain the terms natural and artificial immunity.	Lectures.	
	4.5 Explain the term complement.		
	4.6 Prepare and standardize complement.		
	4.7 Prepare and standardize hemolytic.	Conduct practical	Glasswares reagents.
	4.8 Prepare an indicator system.	"	
	4.9 Carry out complement-fixation proper.	"	

WEEK	General Objectives 5.0 Understand antigen-antibody and the significance of immunology on public health.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	5.1 Explain the various antigen-antibody reactions.	List common examples	
	5.2 Explain the various types of hypersensitivity (delayed, immediate etc.) and allergic reactions.	Use audio visuals	
	5.3 Describe the factors affecting antigen-antibody reactions.	Lecture	
	5.4 Explain the A,B,O Blood grouping (blood and serum).	"	
	5.5 Explain the rhesus factor and blood and rhesus incompatibilities.	Show examples	
	5.6 Carry out any of the following reactions; Agglutination, precipitation etc.	Conduct practical, on agglutination, Precipitation	
	5.7 Explain the mechanism of resistance to infection.	Lecture	
	5.8 Explain the relationship of infection to immunity.	"	
	5.9 Explain the interaction of drugs to the immune system.	Describe examples.	
	5.10 List common communicable diseases in Nigeria e.g. Cholera, AIDS, etc.	Use charts and films and slides.	**Overhead projector**
	5.11 Explain the immune measures against the diseases in 5.10 above.		
	5.12 Distinguish between epidemics, endemics and pan emics etc.	Field mp'	
	5.13 Explain the control and preventive methods applicable to each situation in 5.12 above.	"	

PRACTICAL CONTENTS

WEEK	PRACTICAL	STEACHERS ACTIVITIES	RESOURCES
1-8	1.2 Analyse the separation of the components of disrupted cells	Demonstrate experiments on cell separation techniques	Microscope, cell tissue
	1.5 Carry out the following stemming techniques gram slain, spone Stan flagella stain	Supervise students on staining techniques	Microscope
13-14	4.6 Prepare and standardize complement 4.7 Prepare a standardize hemolytic 4.8 Prepare an indicator system	Conduct practical on standardize complement Conduct practical on standardize hemolytic Conduct practical on how to prepare indicators	Glass wares Reagents Reagents
	5.6 Carry out any of the following Feat ions, Agglutination, precipitation etc	Conduct practical on agglutination, precepitation	Reagents BNlood sample

PROGRAMME:	BIOCHEMISTRY HIGHER NATIONAL DIPLOMA
COURSE:	REGULATION OF CELL METABOLISM
CODE:	STH 323
DURATION:	60 Hours/15Weeks/Lecture = 2, Tutorials = 0 Practicals=3
UNIT:	3.0
GOAL:	This course is designed to enable the diplomates with an understanding Of the general principles in the regulation/control of biochemical reaction that Occurs in the cell.
GENERAL OBJECTIVES;	On completion of the course the diplomate should be able to: 1.0 Understand the concept of Homoeostasis 2.0 Understand the effect of the hormones on cellular metabolism. 3.0 Understand the mechanism of enzyme regulation/control 4.0 Understand the methods of PH fluid and electrolyte control in the body. 5.0 Understand the genetic factors that regulate the intracellular concentration of various proteins.

PROGRAMME : HND BIOCHEMISTRY			
Course: Regulation of Cell Metabolism	**Course Code: STH 323**	**Contact Hours 60 Hours 2-0-2**	
Course Goal: The course is designed to enable the students with a clear understanding of the general principle in the regulation/control of biochemical reaction that occurs in the cel			
WEEK	**General Objectives : 1.0** Understand the concept of Homoeostasis		
	Special Learning Objective:	**Teaching Activities**	**Resources**
1-2	<u>Homoeostasis</u> Explain the term homoeostasis. Distinguish between negative feedback and positive feedback. Describe a homeostatic control system.	Demonstration and class lectures and discussions Illustrate and demonstrations	Teaching tools “ “

	2.1 Describe the constitution, types, body. 2.2 <u>Hormones</u> 2.3.2 See P.84 – P.86. 2.3 Explain the role of the following substances in plants: 2.4 (a) auxins. (b) gibberellins. (c) Kinetin (d) Ethylene 2.5 Differentiate between the role of vitamins and hormones in growth. 2.6 Isolate and purify hormones and hormone like. Substances from different laboratory animals and plants. 2.7 Identify neutral ketosteroids (Androgen) in urine samples. 2.8 Identify and determine pregnanediol in urine (derived from progesterone) 2.9 Identify and determine estrogen in urine. 2.10Determine adrenaline and non adrenaline by ferricyanide method.	Lectures Practical isolation and purification, students to work individually. Practical Identification of neutral 17. ketostroids (Androgens) in urine samples. Practically identification and determination of Pregnanediol in urine (derived from progesterone) Practically identify and determine the estrogen in urine. Determine adrenaline and non adrenaline by termcyanide oxidation.	Charts showing the major endocrine glands and their secretions. Charts showing the hormones involved in regulation of moulting in insect metamorphosis. Glasswares and reagents. Using Callow's original method. Using venning methods. Using Kuber methods

WEEK	General Objectives : 3.0 Understand the mechanism of enzyme regulation/control.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
3 - 4	Explain the need for the regulation of enzyme catalysed biochemical reaction. List types of enzymes regulation e.g. (a) Allosteric (b) Covalent modification 3.3 Describe the features of feed back control mechanism in enzyme regulation. 3.4 Explain product inhibition in enzyme regulation. 3.5 Explain the term covalent modification.	Demonstrations, classroom discussions and lectures. Lecture	Teaching tools

WEEK	**General Objectives: 4.0** Understand the methods of PH fluid and electrolyte control in the body.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	4.1 Explain, buffer systems. 4.2 Explain the role of respiration in the control of blood PH. 4.3 Explain the limitations of respiratory control of blood PH. 4.4 Explain major regulatory functions of the kidneys. 4.5 Describe renal control of acid-base reabsorbed secretion of Hx and synthesis of MHx salts. 4.6 Distinguish between respiratory and metabolic acidosis. 4.7 Distinguish between respiratory and metabolic alkalosis.	Lectures and demonstrations, and Assignments. Lecture.	Teaching tools.

WEEK	**General Objectives : 5.0** Understand the genetic factors that regulate the intracellular concentration of various proteins.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
	5.1 Explain the term gene.	Discuss and Lecture the term gene.	Teaching tools
	5.2 Explain gene expression as form of protein synthesis	Describe gene expression as form of protein synthesis.	"
	5.3 Describe the general pathway for gene expression (from gene to polypeptide products).		"
	Explain how regulation of gene expression may occur at one or several of the many steps in 5.3 above (transcription, modification, translation, etc).	Identify and lecture	"
	Explain how operon is a coordinated unit on gene expression.	"	"
	Explain genetic elements of these operon are a regulator gene, as a operator gene and as a set of structural gene, respectively.	"	"
	Describe hoe the regulator gene produces a repressor (protein) that can interfere with the operator gene.	"	"
	Describe the effect of the binding of the repressor to the operator in the transcription of the structural gene.	"	"
	Describe the histidine operon as an example of repressible operon,	"	"
	Describe two features of regulatory processes found in eukaryotic but not found in prokaryotic system (hormone effects and protein stability).	"	"
	Describe the tryptophan pyrollax gene function to illustrate the two features in 5.10 above.	"	"
	Explain how CAMP stimulate the transcription of several inducible operon.	"	"

NO PRACTICALS

WEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
3-5	Isolate and purify hormones and hormonelike substances from different laboratory animals and plants	Practical isolation and purification.	Glass ware and reagent

PROGRAMME: BIOCHEMISTRY (HIGER NATIONAL DIPLOMA)
COURSE: NUTRITIONAL BIOCHEMISTRY I
CODE: STH 324
DURATION: 60Hours/15Weeks/ Lecture = 1 Tutorials = 0 Practical = 3
UNIT: 2.0
GOAL: This course is designed to provide the student with the knowledge of the Biochemistry of food and nutrition in maintaining cellular function and integrity.

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

1.0 Understand the role of carbohydrate, protein,and fat in the maintainance of integrity.
2.0 Understand the biochemical importance of vitamins and inorganic ions in nutrition.

PROGRAMME: HND BIOCHEMISTRY			
Course: Nutritional Biochemistry II	**Course Code: STH 324**	**Contact Hours 60 Hours 1-0-3**	
Course Goal: The course is designed to provide the student with the knowledge of the biochemistry of food and the of nutrition in maintaining cellular function and integrity.			
WEEK	**General Objectives 1.0 Understand the role of carbohydrates, protein, and fat in the maintenance of the integrity of the living cell.**		
		Teaching Activities	**Resources**
1-3 4-7		Demonstrations, exhibitions on malnutrition.	Audio visual aids.

NO PRACTICALS

PROGRAMME:	BIOCHEMSITRY HIGER NATIONAL DIPLOMA
COURSE:	PHYSICAL BIOCHEMISTRY II
CODE:	STH 325
DURATION:	60Hours/14 Weeks (Lecture 2 Tutorials = 0 Practicals = 2
UNIT:	3.0
GOAL:	This course is designed to provide the diplomate with a basic knowledge of physical biochemistry
GENERAL OBJECTIVES:	On completion of this course, the diplomate should be able to: 1.0 Understand the application of thermodynamics and chemical equation 2.0 Understand the basic principles of enzyme catalysed reaction.

HND BIOCHEMISTRY			
Physical Biochemistry II	**Course Code: STH 325**	**60 2-02**	
Course Specification:			
WEEK	**1.0 Understand the application of thermodynamics & chemical equilibrium**		
1-4	**Special Learning Objective:**	**Teaching Activities**	**Resources**
	1.1 -Describe the three types of thermodynamic systems as isolated, closed and open. 1.2 –Explain the thermodynamics of open systems. 1.3 –Explain how a living cell constitutes an open system. 1.4 –Explain thermodynamic equilibrium. 1.5 –Explain how chemical processes in the living cell are dynamic in nature. 1.6 –State the $1^{st,}$ 2^{nd} and 3^{rd} laws of thermodynamics. 1.7 –Explain the terms enthalpy entropy and free energy. 1.8 –Explain the relationship between enthalpy and free energy.	Demonstrations Classroom Discussions and lectures “ “ “ “ “ “ “	Audio visuals Models. “ “ “ “ “

WEEK	1.0 Understand the application of thermodynamics & chemical equilibrium		
1-4	**Special Learning Objective:**	**Teaching Learning Activities**	**Resources**
	1.9Explain the standard free energy of formation, and free energy change.	Lecture	"
	1.10 Explain the relationship between free energy change constant, PH and concentration.	"	"
	1.10Explain the terms activity co-efficient and molar activity coefficient.	"	"
	1.11Illustrate graphically the variation of Gibbs free energy (G) content with composition of reaction mixture.	"	"
	1.12Explain how enzyme catalysis does not alter chemical equilibrium but only quicken it's attainment by lowering the activation energy.	"	"
	1.13 Distinguish between exorganic and endergomic reactions.	"	"
	1.14Explain how reactions with + G" values are accomplished in the cell.	"	"
	1.15Explain the term high energy compound.	"	"
		"	"

	1.15Identify some high energy compounds that are used as agent of coupling exorganic and endergonic reaction. 1.16Describe the ATP cycle. 1.17Explain the standard free energy of hydralysis of ATP. 1.18Describe the structural basis of the free energy during hydralysis of ATP. 1.19Explain the transfer of phosphate Gps from ATP to AMP and pyrophosphate. 1.20Describe the role of AMP and pyrophosphate.	“ “ “ “	“ “ “ “

WEEK	General Objectives : 2.0 Understand the basic Principles of enzyme Catalysed reaction.		
		TeachersActivities	**Resources**
5-14	**<u>Enzymes</u>** Describe the distinctive features of enzymes e.g. active site specifically etc. Explain enzymes specifically as the basis of classification. Determine acid and Alkaline phosphates optimum PH. Determine the effect of activators and inhibitors experimentally. Explain and determine enzymatic catalysis measurement by the rate of disappearance of substrate or formation of products. Define enzyme activity and specific enzyme activity in international units (I>U) and S>I unit. Explain methods of enzyme assay. Carry out enzymatic assay of a coloured substrate e.g. 4 nutropheny/phosphate by acid or alkaline phosphate. Describe the assay for enzyme activity for a turbid substrate like milk e.g. xanthine oxidase in milk. Explain coupled enzyme assays.	Lecture “ Carry out practicals on alkaline phosphatase and PH – PH meter. Practical determination of effect of activators and inhibitors. Carry out experiment on the rate of enzyme catalysis. “ “ “ “	Teaching tools PH meter. Practicals Practical - Enzymes different types - Reagents - Burrettes - Anvettes - Spectrophotometer - Chromatograph - “

WEEK	General Objectives :		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	Illustrate 2.10 above with assay of the reaction F-G-P = G-G-P. Explain how an enzyme reversibly combines, first with its substrate to form an enzyme substrate complex. Explain why the process of product formation from 2.10 above is a slow process. Explain the term Rapid Equilibrium on the basis of 2.12 and 2.13 above. Explain steady state and Pre-steady state. Illustrate 2.15 above with the equation. E + S ES OR A B C V_1 V_2 V_3 Explain and determine enzyme-catalysed reactions measurement under initial rate (Vo) conditions Derive the Michealis-Menten equation from the expression: k1 K3 E+S ES E+P K2 k4 2.19 Explain the Kinetic constant, Km, Vmax, Kcat.	“ “ “ “ “ “ Lecture and Carry out experiment to measure velocity “	Practical

WEEK	General Objective: Understand the basic Principles of enzyme Catalysed reactions.		
	Special Learning Objectives:	**Teachers/Learning Activities**	**Resources**
	Explain the physiological significance of Km. Describe the determination of Km and Vmax using line weaver Buck plots. Show that Km and Vmax can also determined by Eddie-Hotset plots. Carry out calculations/plots based on 2.17-2.20 above. Determine experimentally, the Km and Vmax of an enzyme or fixed enzyme concentration. Define cofactors, activators, co-enzymes and prosthetic groups. Explain how the rate of enzymatic catalysis can be affected by the presence of cofactors and inhibitors. Define reversible inhibitors. Distinguish 2.26 above using the line Weaver-Buck plots. Distinguish between competitive, non uncompetitive inhibitors. Explain how some enzymes have more than one polypeptide chain.		Practical. - Practical - Different enzymes - Spectrophotometer. “ Teaching tools.

WEEK	General Objectives: Understand the basic principles of enzyme catalysed reaction.		
	Special Learning Objective:	**Teachers/Learning Activities**	
	Define allosteric enzymes. Explain that allosteric enzymes are usually key enzymes in metabolic pathways. Explain how allosteric enzymes obey sigmoidal kinetics. Describe the properties of allosteric enzymes. Illustrate 3.34 above with binding of oxygen to heamoglobin. Explain the hill equation. Describe the properties and mode of action of aspartate isoenzymes. Explain isoenzymes. Distinguish isoenzymes from allosteric enzymes. Illustrate experimentally the use of electrophoresis in the study of isoenzymes as being genetic and post-translational. State the origin of isoenzymes as being genetic and post-translational. 2.42Explain the importance of enzymes in developmental biology.	“ Carry out experiment on electrophoresis using enzymes. “ “ “ “ “ Laboratory practicals on liver function and other organ functions. “	Electrophoretic tank. Teaching tools. Practicals Spectrophotometer Blood samples. - Practicals - Same as above.

WEEK	General Objectives		
	Special Learning Objective:	**Teachers/Learning Activities**	
	2.43Describe the uses of isoenzymes in biological identification and classifications. 2.44Define Maker enzymes and enzymes compartilization. 2.45Describe the use of Maker enzymes in cell fractionation. 2.46List examples in 2.43 above. 2.47Carry out the determination of GTP and ATP. 2.48Carry out experimentally the marker enzymes for liver function, postrate heart, kidney function etc. using the serum.	Lecture “ “ “ Laboratory practicals on liver function and other organ functions.	

PRACTICAL CONTENTS

WEEK	PRACTICAL	TEACHERS ACTIVITIES	RESOURCES
5-14	Carry out enzymaticessay of goloared substrate e.g nutrophenylplosphate by acid or alkaline phosphate 2.40 Illustrate experimentally the use of electrophocesis in the study of isoenymes as being genetic and post translational 2.48 Carry out experimentally the nmarker enzymes for liver function, postrate, heart, kidney functions etc using the serum	Conduct practical on the rate of enzyme catalysis Laboratory practicals on liver function and other organ functions	Reagents Different types of enzymes Connect floste Blood samples spectrophotometer

PROGRAMME:	BIOCHEMISTRY (HND)
COURSE:	BIOCHEMICAL METHOD II
CODE:	STH 321
DURATION:	75Hours/15Weeks (2Hours Lecture, Tutorials 0 3 hours practical
UNIT:	3.0
GOAL:	This course is designed to enable the diplomate with a clear understandingof the Principle and application of biochemical methods.
GENERAL OBJECTIVES:	On completion of this course the student should be able to:

1.0 Understand electrophoresis as a method of separation and identification based on movement of charged molecule.
2.0 Understand the principle application of spectrophotometrey
3.0 Understand the principle and application of spectro flourimetry.
4.0 Understand the principle and application of chromatography methods.
5.0 Understand the principle and application of the potentiometric methods.

PROGRAMME: HND BIOCHEMISTRY			
Course: BIOCHEMICAL METHOD. II	**Course Code: STH 321**	**Contact Hours 75 Hours 2-0-3**	
GOAL: This course is designed to enable the student with a dear understanding of the principle and application of biochemical methods.			
WEEK	**General Objectives : 1.0 Understand electrophoresis as a method of separation and identification based on movement of charged molecules.**		
	Special Learning Objective:	**Teaching Learning Activities**	**Resources**
1 - 2	1.0 Understand electrophoresis as a method of separation and identification based on movement of charged molecules in an electric field. **<u>Electrophoresis</u>** 1.1 Define electrophoresis. 1.2 Explain the principles/theory of electrophoresis. 1.3 Explain the factors that govern the behaviour of charged particles in an electric field. 1.4 Describe the effect of the mobility particles (e.g PH osmotic flow, diffusion, etc.) during electrophoresis. 1.5 Describe the effect of the intensity of an electric field, power supply, current type of buffer used etc. on electrophoretic run.	Carry out experiment on separation techniques using electrophoretic apparatus. Practical “	

WEEK	General Objectives		
	Special Learning Objective:	**Teachers/Learning Activities**	
	1.6 Demonstrate electrophoretic run in gel. 1.7 Draw the circuit diagram of an electrophoresis power supply. 1.8 Describe the precautionary measures adopted in high voltage Electro-phoresis. 1.9 Describe and apply methods of sample application and markers/standards in Electrophoresis. 1.10Detect and estimate sample components. 1.11Identify in electrophoresis the different types of support media. 1.12Prepare different support media. 1.13Describe the different types of electrophoresis e.g high voltage, moving boundary, Iso-electro focusing etc. 1.14List the application of electrophoresic. 1.15Identify voltage, movement of ion (in cm) and Development time in Electrophoretic run repor	Practical demonstration in lab. Conduct studio drawing. Conduct practical. Conduct practical. Demonstrate experiment on sample separation.. Demonstrate the different types of electrophoresis.	Drawing studio. Electrophoretic material. “ “ “

WEEK	General Objectives : 2.0 Understand the Principle of Spectrophotometry

	Special Learning Objective:	Teachers/Learning Activities	Resources
3-4	**Spectrophotometry** 2.1- Explain the electromagnetic emission spectrum. 2.2- Explain the theory of light absorbtion and transmission (Beer lamber law). 2.3- Draw a schematic digram fo U.V/visible spectrophotometer (poer supply, sight sources, manochromators, detecto and measuring device). 2.4- Identify the five main sections of spectrophotometer (radiation source, monochromator, photometer, sample area and detector area). 2.5- Describe the types of light sources, cells regions of the spectrum covered by visible and U.V spectrophotometer. 2.6- Describe the operation of the spectrophoto meter. 2.7- Describe the transmissive power of solvents (against distilled water). 2.8- Describe the absorbance characteristics of some compound, e.g potassium dichromate, Haemoglobin etc. 2.9- Describe ultraviolet spectrum as plot of the wave length or frequency of absorption versus the absorption intensity.	Demonstrate the spectrum. Studio drawing. Makes sketches for grading. Supervise students use the spectrophotometer. Demonstrations using spectrophotometer. “	Spectrophotometer. Teaching tools.

WEEK	General Objectives : 2.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**

	Explain the Expression = $\frac{A}{60}$ For intensity absorption.	"	Teaching tools
	Explain the effect of PH on absorption spectra.	"	"
	Explain the term 'Chromaphoresic' anxochrome batha 'chromic shift' hyperchronic effect.		
	Describe and apply the precautions for effective sample handling in spectrophotometry.	Laboratory demonstration.	Spectrophotometer
	List applications of u.v./visible spectrophotometers.		
	Determine and maintain a catalogue of the spectra for important biological compounds.	Practicals using spectrophotometer. Grade results.	
	Identify components for a mixture (e.g drug) from their absorption spectra.	"	
	Produce standard curves and determin the concentration of sample solution from these curves.	Experiment on absorption spectral method.	
	Explain enzyme activity by u.v. spectraidin absorption.	Practicals using spectrophotometer.	
	Explain enzyme activity by u.v spectraidin absorption.		

WEEK	General Objectives : 3.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective: **Spectroflourimetry**	**Teachers/Learning Activities**	**Resources**
5 - 6	Explain the phenomenon of fluorescence. Explain that the intensity of fluorescence is properties to the concentration of the substance in solution. Explain the Phenomenon of "quenching". Identify the parts of a spectroflourimeter light sources, monochromator, light trap, photomultoplic recorder. Describe diagramatically, the outlay of a spectroflourimeter. Describe the methods of preparation of a sample for analysis by spectroflourimetry. Prepare sample for analysis by spectroflourimeter. Describe the operations of a flourometer. Explain the applications of flourimetry and its limitations in analytical work. Prepare standard curves for spectroflourimetric determination. Analyse samples using spectroflourimeter.	Demonstration and lectures. " " Grade sketches. " Practical sample preparation. Practical sample analysis.	" Spectroflourimeter. " "

WEEK	General Objectives : 4.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective: **<u>Chromatography</u>**	**Teachers/Learning Activities**	**Resources**
7-9	Explain the term chromatography. Describe the various principle of chromatography. Classify types of chromatography: Liquid-solid, liquid-liquid, and gas-liquid Carry out thin layer and paper chromatograph. Explain the following terms used in chromatography:- RF values, solvent front, pertition coefficient,stationary and mobile phases, retention time. Identify types of absorbents and ion-Exchange resins used in chromatography. Describe the chromatography properties of absorbents and ion-Exchange resins. E.g. absorbtive powers, weak and strong Exchangers etc. Desribe different methods of developing chromatograms e.g sample elution, frontal analysis and gradient elution. Identify solvents used in chromatography and describe their eluting powers and properties. Describe the process of thin layer chromatography (TLC). Carry out separation using thin layer chromatography.	Demonstration and lectures. Supervise student's practicals. " Practical identification and discription of absorbents and ion exchange resins. " Practical identification. Demonstrate the process. Grade practicals.	Various chromatrographic equipment and instruments. Chromatography apparatus. Absorbents. TLC materials

WEEK	General Objectives : 4.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective:		**Resources**
9-10	Describe methods of spreading layers in T.L.C. Describe methods of preparation, application and location of samples in TLC. List and identify locating agents. Described methods of identification of components of TLC. Carry separations using thin layer chromatograph. Explain the principle of gel-permeation (molecular steve) chromatography.	Demonstration Demonstration Practical identification. “ Conduct and grade practicals.	 TLC samples Locating agents. TLC materials.

	Gel permeation chromatography Identify the media used for gel-permeation chromatography (e.g gel-resins). Describe gel-permeation chromatography. Find the molecular weight of macromolecules (e.g proteins) using permeation chromatography. Describe the relative advantage/disadvantages of the various media used in permeation chromatography above. **Biological affinity chromatography** Explain the bases for biological, affinity chromatography. Describe biological affinity chromatography. Identify the matrices for gel-affinity chromatography. Explain the characteristics of the matrices for gel permeation chromatography. 4.26 Describe the procedure for the linkage of ligand and supporting matrix (Activiation of matrix and coupling to ligand)	Practical identification. Conduct and grade practical on use of permeation chromatography. Demonstration and lectures. Practical identification.	Permeation chromatography. Biological affinity Chromatography.

WEEK	General Objectives : 4.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
10 -12	**<u>Gas-liquid chromatograph</u>** Describe gas-liquid chromatography as a form of column chromatography in which the stationary phase is liquid and the mobile phase is a gas. Illustrate diagrammatically the arrangement or layout of the components of a gas-liquid, liquid-liquid chromatography. Identify different types of detectors e.g thermal conductivity detector, flame cornization detector, electron capture detector. Separate samples using GLC. Explain the working of various detectors in 3.26 above.	Drawing. Practical identification of detectors Practical separation and reports.	Gas-liquid-chromatograph Various detectors. Gas-liquid chromatograph.
WEEK	**General Objectives : 4.0 Understand the Principle of Spectrophotometry**		
	Special Learning Objective:		**Resources**
	<u>Column chromatograph</u> Describe the various methods of column preparation i.e. packing of column (e.g. Dry and wet packaging). Prepare columns. State the relative advantage of the different methods of column preparation in 4.31 above. Describe the preparation and application os samples for gas-liquid/-liquid chromatography. Prepare and apply samples in gas-liquid, liquid-liquid chromatograph. Determine column efficiency, adjusted retention time. Determine kovat indeces and MCR cynold constants	Supervise column preparation. Practical preparation of samples and application.	GLC, liquid-liquid chromatograph.

WEEK	General Objectives : 4.0 Understand the Principle of Spectrophotometry		
	Special Learning Objective: Compare the values in 3.32 above with those in the relevant literature. List the applications of the various chromatographic techniques. **<u>Absorition chromatography</u>** Carry out absorption chromatography. Prepare column and sample for chromatographic separations. Recondition absorbents. Determine the choice of absorbents for a chromatographic separate. Measure R.F values.	**Teachers/Learning Activities** Conduct practical and grade results. “ “ “ “ “	**Resources** Absorption chromatograph

WEEK	General Objectives : 5.0 Understand the Principle and application of potentiometric methods.			
	Special Learning Objective:	**Teachers Activities**	**Resources**	
13-14	**<u>Potentiometric methods</u>** Explain the relationship between the electrode potential of a reference electrode and the ionic concentration of the solution in which it is immersed:- i.e $E_{Ref} = E - \frac{RT}{F}$ in C (nerst Equation) Explain the relationship between electrode potential and PH i.e $E = E + \frac{2.303RT}{F}$ (PH outside) Describe a PH meter as a precision instrument for PH measurement. Identify the components of a PH meter. Describe the functions of the components of 7 PH meter.	Demonstration and lectures. “ Demonstration. Practical identification and sketches. “	Teaching tools. “ PH meter. “	

	Draw the diagram of a PH meter. Explain with examples, the term "ion-specific electrodes". Describe the set-up for a potentiametric titration with the aid of a schematic diagram. List and explain the application of potentiometric measurements in biochemical analysis. Calibrate the PH meter. Measure the PH of a solution using PH meter. Determine the pcb and pka values from titration, data. Compare Experimental results with calculated results from : PH = pka + log (salt)/(Base) Calibrate the electrode. Describe and apply the use of calibrated electrodes in respiratory and photosynthesis (gas exchange).	Grade drawings. Grade diagram " Practicals " " Practical calibration, Grade results. Practicals.	 PH meter " " Electrode.	

WEEK	PRACTICALS	TEACHTERS ACTIVITIES	RESOURCES
1-2	1.0 Cary out method of separation and identify feat ion based on the movement of charged molecules in an deictic field.	Conduct practical on separation techniques using electrophoresis apparatus	Electrophoresis tank
	3.7 Prepare sample for analysis by spectroflourimeter.	Practicals on sample preparation	Spectroflorimeter
5-6	3.10Prepare standard curves for spectroflorimeter	Practicals on standard curve preparation	Spectroflorimeter
	Cary out thin layer and paper chromatography graph.	Supervise student's practical on thin layer and paper chromatography	
7-9	4.10Carry out separation using thin layer chromatography.	Conduct practical on separation techniques using (TIC)	
	4.29 Separate samples using GLC	Practical separation and reports	Gas liquid chromatography
	4.32 Prepare columns		Gas liquid chromatography
	4.35 Prepare and apply samples in gas-liquid chromatography	Supervise column preparation Practical preparation of samples and application	
	4.39 Carry out absorption chromatography	Conduct practical on absorption chromatography and grade result	Absorption chromatography
	4.40 Prepare column and sample for chromatographic separation	Supervise column preparation and sample separation	
13-14	5.10 Calibrate pH meter	Supervise students to calibrate pH meter	pH meter
	5.11 Measure the pH of a solution using pH meter	Conduct practical on pH meter	pH meter
	5.14 Calibrate electrode	Supervise students to calibrate electrode	Electrode equipments

PROGRAMME:HND BIOCHEMISTRY

Course: INTERMIDIARY METABOLISM I	**Course Code: STH 322**	**Contact Hours75 hours 2-0-3**
GOAL: This course is designed to acquaint the student with the principles involved in intermediary metabolism		
WEEK	**General Objectives: 1.0 Understand the Phenomenon of intermediary metabolism**	
1 - 3		

<u>Intermediary metabolism</u> 1.1 Explain that metabolism in a living cell constitute catabolic (breakdown) and anabolic (synthesis) processes which occur simultaneously. 1.2 Explain intermediary metabolism as the interchangeability of derivatives (metabolites) of carbohydrates, proteins and fats (lipids) via reactions mediated by appropriate enzymes and coupled by relevant coenzymes/cofactors. 1.3 Illustrate and explain intermediary metabolism by a simple schematic diagram e.g. 1.4 Illustrate the central role of acetyl Coa intermediary metabolism. 1.5 Describe how the energy for cellular metabolism is derived from the break down of acetyl COA. 1.6 Explain how the energy from 1.5 above is captured ina the form of ATP (adenosine triphosphate) which is revisable.	Illustrated lectures. “ “ “ “ “	Charts and audio visuals. “

WEEK	General Objectives:		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	1.7 Describe ATP as the universal energy currency in biological systems.	"	
	1.8 Explain how energy released from the degradation of some substrates may be utilized in the formation of other cellular components.	"	
	1.9 Explain that the sum total of breakdown of carbohydrates, fats and proteins is a chain reaction involving transfer of reactions which lead to the final products of cellular respiration (Co2 + H2o) and ATP.	"	
	1.10 Describe the ATP cycle and explain how ATP forms the energy currency in biological system.	"	

WEEK	General Objectives: 2.0 Understand the Pathways of carbohydrate, protein and lipid metabolism.		
	Special Learning Objective:	**Teaching Learning Activities**	**Resources**
4 - 6	**<u>Nutrient metabolism</u>**		
	List the enzymes and products of digestion of carbohydrate.	Illustrate lectures	
	Explain the term substrate level phosphorylation.	"	
	Define glycolysis as the pathway of breakdown of phosphorylated sugars to provide and lactate.	"	
	Describe the glycolytic pathway and the conversion of pyruvate to acetyl COA.	"	
	List the key enzymes of glycolysis.	"	
	Identify the steps that consume or yield energy in glycolytic pathway.	"	
	Deduce the net energy yield of this glycolytic pathway.	"	
	Distinguish between aerobi and anaerobi glycolysis.	"	
	Describe the alternative pathway of glucose oxidation (pentose phosphate pathway/hexose monophosphate shunt)	"	
	State the biochemical importance of 2.9 above.	"	
	Describe glucogenesis, gluconeogenesis, slycogeresis and glycogenelysis.	"	
	Describe cori cycle.		

WEEK	General Objectives : 2.0 Carbohydrate Metabolisim		
	Special Learning Objective:	**TeachersActivities**	
	2.13 Explain Pasteur effect. 2.14Define oxidation of fatty acids. 2.15Describe the processes occurring in fatty acid oxidation (activation dehydrogenation, hydration, further dehydrogenation and Thiaclastic cleavage). 2.16 Explain how all reaction of B-oxidation of fatty acid are reversible. 2.17 Explain how fatty acids undergo activation in the cytosol and enters the mitochondrior where it undergoes B-oxidation. 2.18Describe the B-oxidation of fatty acids to acetyl COA.	**“** **“** “ Lecture “ “ “	

7-8	2.19 Explain that the acetyl COA produced in fatty acid oxidation enters the TCA cycle for further degradation. 2.20 Describe the oxidation Via propionic acid of branched and odd-numbered fatty acids. 2.21Determine degree of unsaturation and unsaponifiable fraction. 2.22 Explain that FADH2 and NADH + H+ produced in fatty acid oxidation are also oxidized through the electron transport system of the mitochondria eventually by molecular oxygen. 2.23 Determine the energy yield in terms of ATP molecules for the complete degradation of a named fatty acid e.g. palmitic acid or oleic acid. 2.24 Compare the energy yield when one mole each of saturated and unsaturated fatty acid of equal chain length is completely oxidized. 2.25Describe the formation and metabolism of ketone bodies (acetone, acetoacetate and P-hydroxy butyrate). Describe the biosynthesis of fatty acids. Describe the two pathways of fatty acid biosynthesis (cytoplasmic mitochondrial). Explain that the cytoplasmic pathway is the major pathway of fatty acid synthesis. Describe the biosynthesis of triglycerides and phosphatides (phospholipids). Describe the biosynthesis of sterols from cholestrol. Identify experimentally metone bodies in abnormal urine. List the enzymes and products of protein digestion. Explain how amino acids can be a source of cellular energy (surplus amino acids).	Practical on unsaturation. “ “ “

WEEK	General Objectives :		
	Special Learning Objective:	**Teachers Activities**	**Resources**
9.10	2.26Explain how acetyl COA also acts as precursor in the biosynthesis of fatty acids. 2.27 Carry out determination of ketene bodies, cholesterol level. 2.28 Describe the biosynthesis of fatty acids. 2.29 Describe the two pathways of fatty acid biosynthesis (cytoplasmic mitochondrial). 2.30 Explain that the cytoplasmic pathway is the major pathway of fatty acid synthesis. 2.31 Describe the biosynthesis of triglycerides and phosphatides (phospholipids). Describe the biosynthesis of sterols from cholestrol. Identify experimentally ketone bodies in abnormal urine. List the enzymes and products of protein digestion. Explain how amino acids can be a source of cellular energy (surplus amino acids).	Practical determination of ketone bodies and chlestraol level Illustrate lectures. “ Practical identification of ketone bodies in urine.	

	Explain how the c.Skeleton of amino acids are either converted into fatty acids are either converted into fatty acids and glucose or oxidized via the TCA cycle. Explain the terms, ketogenic and glucogenic amino acids. List ketogenic and glucogenic amono acids. Explain transmination and oxidative deamination. Write chemical equations to illustrate the process in 2.37 above. Describe the formation of urea (urea cycle). Test for urea in urine qualitatively and quantitatively.	Conduct practicals on tests for urea.

WEEK	General Objectives :3.0 Correlations in Intermediary metabolism		
	Special Learning Objective:	**Teachers Activities**	
11 - 12	Explain that for each molecule of NADH + H + oxidized, 3 ATP molecules are produced and for each molecule of FADH2 oxidised 2 molecules of ATP are formed. Determine the number of molecules of ATP produced per molecule of pyruvate. Determine the number of molecules of ATP produced by the complete degradation of a molecule of glucose. Determine the number of ATP molecules produced in eukayotes and prokaryotes from the complete degradation of 1 molecules of glucose. Explain the TCA cycles as th common pathway for the degradation of products derived from carbohydrates, lipid and protein metabolisms and synthesis of other substrates and compound (e.g haem-nny system and amino acid) via ketoglutarate carbohydrates via oxalacetate and phosphen al pyruvate or c-skeleton of fats. State that nearly all the Co_2 is produced in the TCA cycle.	“ Calculations. “ “ “ “	

WEEK	General Objectives :		
	Special Learning Objective:	**TeachersActivities**	**Resources**
13-14	Explain that most of the energy from the decomposition of food stuffs is produced in the respiratory chain. Explain that in micro-organism a variation of the TCA cycle (viz the glycoxylate cycle) is obtained. Explain why in the glycoxylate cycle the emphasis is not on degradation of acetate but rather on synthesis of succinate, malete and oxaloacotate (and eventually of carbohydrates) from acetyl COA. Illustrate with the aid of a schematic diagram, the glyoxylate cycle. Explain why the glyoxylate cycle does not exist in the mammaliam organisim. Eplain how the glyoxylate cycle plain a domanant role in plant seedings, which utilize fat reserves for synthetic purposes, and in microorganisms which grow on fatty acids or acetic acid as an exclusive carbon source. State the features of the ETC. Explain the effect of inhibitors on the respirators chain. Explain that the ETC takes place in the membranes. Identify the different levels of cellular regulations of metabolic pathways.	“ “ “ “ “ “ Lecture. “ “	

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
9-10	2.33 Test for ketone bodies in abnormal urine	Practical identification of ketone bodies in urine	Sample of urine
	2.42 Test for urea in urine quantitatively and qualitatively	Test for urine	Sample of urine

PROGRAMME:	BIOCHEMISTRY HIGHER NATIONAL DIPLOMA
COURSE:	INTERMIDIARY METABOLISM II
CODE:	STH 411
DURATION:	60Hours/14 Weeks / Lectures = 1 Tutorials = 0 Practicals = 3
UNITS	2 Units
GOAL:	This course is designed to enable the diplomate with the principles involved in Intermediary metabolism
GENERAL OBJECTIVES:	On completion of this course, the diplomates should be able to: 1.0 Know the common pool of intermidiary 2.0 Understand nucleic acid metabolism and protein biosynthesis 3.0 Understand nucleic acid metabolism and protein biosynthesis

PROGRAMME: HND BIOCHEMISTRY		
Course: Intermediary Metabolism II	**Course Code: STH 411**	**Contact Hours 60 Hours 1-0-3**
Course Goal: The course is designed to acquaint the students with the principles involved in intermediary metabolism.		

WEEK	General Objectives: 1.0 Know the Common\pool of Intermediary Metabolism		
1 - 3	1.1 escribe the metabolic chart (a comprehensive diagrammatic sketch of the metabolic pathways. 1.2 Explain that metabolic chart reveals that various food shifts and endogenous substances are broken down constantly to produce common intermediates (common pool of metabolites) e.g. acetyl COA, Pyruvate and ketoghitarate, succinate, oxaloacetate, H2, ATP etc. 1.3 Explain that theoretically a specific metabolic pool exists for every substrate. 1.4 List the numerous inlets and outlets of metabolic pool. 1.5 Describe the outlets flows to the TCA cycle to fat synthesis, and to isoprenoid synthesis. 1.6 Describe how molecules are mixed uniformly in such a pool. 1.7 Explain that once submerged in the metabolic pool the origin of a given, molecule (e.g. acetyl CoA), whether from fat, carbohydrate or surplus amino-acid, can no longer be started with certainty. 1.8 Explain how the spread of radioactively labeled fragments over the entire organisms is as a result of 4.7 above.	Illustrated lecture “ “ “ “ “ “	

WEEK	General Objectives: 2.0 Understand nucleic acid metabolism and protein biosynthesis.		
4 - 6	**Special Learning Objective:**	**Teachers Activities**	
	. 2.1 Describe the degradation of purine in man and other primate to produce uric acid. 2.2 Describe the break down of uric acid by some mammals to allantoin. 2.3 Describe the degradation of pyrimidine. 2.4 Describe the methods of excretion of pyrimidine nitrogen. 2.5 Explain how pyrimidine breakdown may occur while the pyrimidine base is still attached as the nucleotide or nuclea side. 2.6 Describe and identify the causes and symptoms of the disease gout in in man. 2.7 Describe the reactions involved in the biosynthesis of purine nucleotides. 2.8 Describe how the various components of the purine ring are derived from formate, Co2, glutamine, aspertate and glycine. 2.9 Compare the pathways of purine synthesis in micro-organisms with those found in the liver of animals. 2.10 Explain why pureness are synthesized de novo, not as free purines, but first as the nucleotide inosinic acid which is then converted into adenine and guanine nuclectides. 2.11 List the enzymes and co-factors in the reaction in 2.10 above.	Lecture “ “ “ “ “ “ “	

WEEK	General Objectives : 2.0 Understand Nucleic acid metabolism and protein biosythesis.		
7 - 9	**Special Learning Objective:**	**Teachers/Learning Activities**	**Resources**
	2.12 Describe the reactions involved in biosynthesis of the pyrimidine ring.	"	
	2.13 Describe the subsequent synthesis of pyrimidine nucleotide starting with orotic acid as precursor.	"	
	2.14 List the enzymes and co-factors on the reaction on 2.10. above.	"	
	2.15 Explain the role of NDA on a carrier of genetic information.	"	
	2.16 Describe the biosynthesis of DNA and RNA.	"	
	2.17 Explain the Watson-crick model of the DNA and it is replication .	"	
	2.18Describe the semi conservative replication of DNA.	"	
	2.19 Describe the Meseion –state experiment for the demonstration of semi-conservative replication of DNA.	"	
	2.20 Describe the 3 main steps involved in replication of DNA (initation, elongation and termination).	Lecture	
	2.21 Explain the role of enzymes polymerase and unwinding protein in DNA replication.	"	
	2.22 Describe the process by which the cell regulated its DNA synthesis.	"	
	2.23Describe the process by which the cell regulated its DNA, resulting from physical, chemical or environmental processes.	"	
	2.24 Explain mutagenesis.		

WEEK	General Objectives: 3.0 Understand nucleic acid metabolism and protein biosynthesis.		
10 - 12	**Special Learning Objective:**	**Teachers/Learning Activities**	
	<u>Nucleic acid metabolism and protein synthesis</u> 3.1 explain how and why amino acids are activated as a pre-requisite in protein synthesis. 3.2 Explain how activated amino acids are linked to transfer RNA (+RNA) by specific synthesis (aminoacyl) +RNA synthesis) 3.3 Explain how the fidelity of protein synthesis depends on the high specificity of aminoacyl + RNA synthetase. 3.4 Describe the nature of the + RNA. 3.5 Explain the suppression of other mutation by mutant + RNA. 3.6 Describe the process of protein synthesis in the rough endoplasmic reticulum in ribosomes. 3.7 Describe the structure of the ribosomes – the organelles of protein synthesis. 3.8 Explain that at RNA molecule may recognize more than one cadon because of wabble. 3.9 Explain how proteins are synthesized in the amino-to carbexy direction. **3.10** Explain that messenger RNA (m RNA) is the carrier of the specific genetic information on protein to be synthesiszed	Lecture “ “ “ “ “ “ “ “ “	

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WEEK	General Objectives : 3.0 Understand nucleic acid metabolism and protein biosynthesis		
	Special Learning Objective:	**Teachers/Learning Activities**	
	3.11explain that messenger RNA is translated in the 5"-3" direction. 3.12 Explain how several aribosornes simultaneously translate a mRNA molecule. 3.13 Explain the initiation of protein synthesis formylmethianine +RNA. 3.14 Explain the process by which an elongation factor delivers aminoacyl +RNA to the appropriate site on the ribosome. 3.15 Explain the formation of peptide bond followed by translocation. 3.16Explain the process of termination of protein synthesis by release factors. 3.17 Explain the process of protein modification following translocation. 3.18 Separate serum protein. 3.19 Determin protein content of liver homogenate or serum by Biuret or lowry methods. 3.20 Isolate and separate nucleic acids. 3.21 Measure and identify nucleic acids. 3.22 Determine base composition of nucleic acids.	Lecture " " " " Carry out experiment on blood sample's separation. Practical isolation and separation of nucleic acid. Practical measurement of nucleic acids. Practical determination of bare composition of nucleic acids.	

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
13-14	3.18 Separate serum protein	Carry out experiment on blood separation	Blood samples
	3.20 Isolate and separate nucleic acid	Practical isolation and separation of nucleic acid	
	3.21 Measure and identify nucleic acid	Practical measurement of nucleic acid	

PROGRAMME:	BIOCHEMISTRY HIGER NATIONAL DIPLOMA
COURSE:	NUTRITIONAL BIOCHEMISTRY II
CODE:	STH 412
DURATION:	60 Hours/15 Weeks/Lecture =2 Tutorials=0 practicals=3
UNIT:	2.0
GOAL:	This course is designed to provide the diplomate with the knowledge of the biochemistry of food and the role of nutrition in maintaining cellular functions and integrity.
GENERAL OBJECTIVES:	On completion of this course, diplomate should be able to: 1.0 Understand principles and practice of nutrition 2.0 Understand food spoilage and the nutritional importance of food processing and preservation.

PROGRAMME: HND BIOCHEMISTRY			
Course: Nutritional Biochemistry II	**Course Code: STH 412**	**Contact Hours : 60 Hours 1:0:3**	
Course Goal: This course is designed to provide the student with the knowledge of the biochemistry of food and the role of nutrition in maintaining celluar functions and integrity.			
WEEK	**General Objectives : 1.0 Understand the Principles and Practice of Nutrition**		
	Special Learning Objective:	**Teaching Activities**	**Resources**
1 - 4	1.1 Explain general nutritional requirements and energy aspects of diets in man.	Illustrated lectures.	Nutritional charts
	1.2 Explain basal metabolic rate (MBR).	"	Audio visuals.
	1.3 Describe the major nutritional disorders in man e.g obesity, kwashiorkor, merasmus.	"	
	1.4 Describe methods involved in nutrition research.	"	"
	1.5 Explain the effects of diet in physiological processes in man.	"	"
	1.6 List primary nutritional disorders (e.g. deficiency diseases).	"	"
	1.7 Explain conditional nutritional disorders.	"	"
	1.8 Describe the relationships between nutrition and public health (effects of carcinogens, enzyme inhibitors and microbial contamination).	"	"
	1.9 Explain the roles of diets (low-protein, protein-free, vitamin-free, high fat etc) on metabolism of drugs and other foreign chemicals in man.	"	"
	1.10Proximate analyses of food, including beverages. 1.11Determine experimentally Biololgical values (BV) of food. 1.12Determine experimentally, Net protein utilization (NPU) on NPU.	Conduct practicals on proximate analysis in 1.10 and 1.11. Practical determination	Chromatographic equipment Spectrophotometer khjadal apparatus soshlexapparatus Glasswares. Food items.

WEEK	General Objectives :		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	1.13Estimate Vitamins and mineral contents of food. **1.14**Identify toxins in foods.	Practical identification, Vitamins, minerals and toxins	“ “

WEEK	General Objectives : 2.0 Understand food spoilage and the nutritional importance of food processing and preservation		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
5 - 14	2.1 Explain food spoilage. 2.2 Explain the cames of food spoilage. 2.3 List different types of food spoilage. 2.4 Outline various techniques of food processing and preservation. 2.5 Explain how food processing enhances digestibility and palatability. 2.6 Explain how processing of food can detoxify food (e.g. cassava cyanide) or produce toxins (Nitrogamines) 2.7 Explain how food processing can destroy endogenous enzyme inhibitors, vitamins etc. 2.8 Explain food processing as a means of preservation. 2.9 Explain the importance and harzards of food additives. 2.10Explain how some food processing techniques (e.g cooking) can adversely affect vitamin availability. 2.11Explain how storage of fats and oils can make them go rancid due to oxidation. 2.12Explain why a rancid fat (oil) has a high content of free fatty Acid (FFA) . **2.13**List unconventional sources of food protein eg leaf protein (cassava) fermentation of waste single cell protein.	Demonstration Lecture “ “ “ “ “ Lecture “ “ “ “ “	Samples of spoiled food items. Food samples. Samples of rancid oil Food samples

WEEK	General Objectives		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	2.11Explain how storage of fats and oils can make them go rancid due to oxidation.	Lecture	
	2.12Explain why a rancid fat (oil) has a high content of free fatty Acid (FFA).	"	
	2.13List unconventional sources of food protein eg leaf protein (cassava) fermentation of waste single cell protein (SCP).	"	Food samples
	2.14Formulate and develop nutritive foods.	"	"
	2.15Explain food texture and nutritive value.	"	"
	2.16Explain quality control in food manufacture/formulation/development.	"	"
	2.17Explain food fortification eg with mineral and vitamins..	"	"
	2.18Explain food supplementation.	"	"

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
1-4	1.11 Determine experimentally biological value (BV) of food.	Conduct practical on proximate analysis	Khjadal apparatus Soxhlet apparatus
	1.12 Determine experimentally net protein ultilization (NPU) on NPU.	Practical determination of NPU ultilization	Glass ware
	1.13 Carry out practical on vitamins and mineral contents of food	Practical identification of vitamin and minerals	Food items

PROGRAMME:	BIOCHEMISTRY HIGER NATIONAL DIPLOMA
COURSE:	BIOTECHNOLOGY AND GENETIC ENGINEERING
CODE:	STH 413
DURATION:	60Hours/15Weeks/ Lecture=1 Tutorial=0 Practicals=3
UNIT:	3.0
GOAL:	This course is designed to enable the diplomates to understand the manupulaion of the genetic coding of micro organisims for the benefit of technology.
GENERAL OBJECTIVES:	On completion on this course, the diplomate should be able to: 1.0 Understand the concept of biotechnology and genetics engineering. 2.0 Understand the significance of biotechnology to medicine 3.0 Understand biotechnology processes. 4.0 Understand the technology of plant and animal cell culture. 5.0 Understand genetics and biotechnology. 6.0 Understanding the concept of genetic engineering. 7.0 Understanding the concept of single cell protein production. 8.0 Understanding the use of isolated biological units or enzymes in industry and medicine. 9.0 Understanding biological fuel generation in biotechnology. 10.0 Known the application of biotechnology in agriculture and forestry. 11.1 Understand the role of biotechnology in environment technologic.

PROGRAMME: HND BIOCHEMISTRY			
Course: Biotechnology and Genetic Engineering	**Course Code: STH 414**	**Contact Hours : 30 Hours**	
Course Goal: Understand the manipulation of the genetic coding of micro-organisms for the benefit of technology			
WEEK	**General Objectives : 1.0 Understanding the Concept of Biotechnology and Genetic Engineering.**		
	Special Learning Objective:	**TeachingActivities**	**Resources**
1 - 2	1.1 Explain the terms Biotechnology and genetic engineering. 1.2 List the various disciplines that constitute Biotechnology.	Illustrated Lectures “	Charts Audio visuals

WEEK	**General Objectives : 2.0 Understand the significance of Biotechnology to medicine.**		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
	2.1 Explain the term antibiotics. 2.2 Describe the roles of biotechnology in the production of antibiotics. 2.3 Describe the roles of biotechnology in the production of Hormones. 2.4 Describe the biotechnology of vaccines and monoclonal antibodies productions.	Lecture. “ “ “	Charts Audio visuals “

WEEK	General Objectives : 3.0 Understand Biotechnological processes.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
3 - 4	3.1 Explain fermentation technology. 3.2 Explain the roles of Biochemists, Microbiologist and chemical engineers in the development of fermentation processes. 3.3 Described openand closed fermenters systems. 3.4 Describe the stages of fermentation process.	Lecture. “ “ “	Laboratory fermentor “ “ “

WEEK	General Objectives : 4.0 Understand the technology of Plant and animal cell culture.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	4.1 Explain cell culture. 4.2 Describe methods of mass cultivation of organisms for biotechnological processes e.g bacteria, yeast, filamentous fungi, plant cell cultures.	Illustrated lectures. “	Media “

WEEK	General Objectives : 5.0 Understand genetics and biotechnology.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
5 - 6	5.1 Identify microorganisms used in biotechnological processes. 5.2 State the properties of microorganisms in 5.1 above. 5.3 Distinguish between structure and regulatory genes. 5.4 Describe the steps involved in the modification of genes to improve productivity e.g. in Enzymes production, bye-product formation improvily yields of metabolites etc. 5.5 Describe the techniques for 5.4 above e.g screening, selection etc. 5.6 Explain the roles of mutation and recombination in modification of organisms genome. 5.7 Describe the processes that facilitate the transfer of genetic materials from one organism to another e.g transformation, transduction etc. 5.8 Explain protoplasm fusion and DNA compatibility. 5.9 Explain the application of protoplast fusion in yield improvements e.g facilitating recombinant DNA transfer, improvement of antibiotics etc.	Microbiological identification and drawings. “ Illustrated lectures “ “ “ “ “ “	Microscopes, Culture media. “ Charts and audio visuals. “ “ “ “ “

WEEK	General Objectives : 6.0 Understand the Concept of Genetic Engineering.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	6.1 Explain the term Genetic Engineering or cloning. 6.2 Describe the process of gene transfer technology i.e. vector or carrier system e.g. splicing system, introduction of vector DNA recombinants. 6.3 List the bioharzards associated with genetic engineering.	Illustrated lectures “ Lecture.	Audio visuals “ Teaching tools

WEEK	General Objectives : 7.0 Understand the Concept of Single cell protein production.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
7 - 8	7.1 Explain the term single cell protein (SCP) and the need for protein. 7.2 List the sources and how SCP is derived from high energy source e.g methanal, gas oil attenoy etc. 7.3 Describe the processes involved in the utilization of waste for the production of SCP. 7.4 Explain the advantages of using organic wastes for SCP production. 7.5 Describe the processes involved in the utilization of complex lingo-cellulose wastes for SCP production. 7.6 Describe the use of agricultural crops, algae etc. in the production of SCP. 7.7 Explain the economic implication of SCP.	Illustrated lectures “ Lecture “ “ “	Audio visuals “ “ “ “ “

WEEK	General Objectives : 8.0 Understand the use of isolated biological units or enzymes in industry and medicine.		
	Special Learning Objective:	**TeachersActivities**	**Resources**
9 - 10	8.1 Explain the term enzyme technology or engineering. 8.2 Identify the various areas of enzyme technology e.g. in production, isolation, purification, immobilization etc. 8.3 Explain the importance of enzyme technology in solving problems in food production, energy shortage, food preservation and improvement of the environment. 8.4 Explain the various areas of industrial application of enzymes e.g. in biological detergents baking industry, dairy industry, starch industry, textile industry, leather industry, medical and pharmaceutical 8.5 Describe the methods of enzyme production. 8.6 Explain immobilization of enzymes on insoluble polymers e.g. membranes, particles etc. 8.7 Explain the various areas of application of immobilized enzymes in industrial processes e.g. production of organic acids, fructose syrup etc. 8.8 List the advantages of using immobilized enzymes or biocatalyst in industrial processes. 8.9 Describe the methods of enzyme immobilization. Physical and chemical methods.	Illustrated lectures “ “ “ “ “ “ “	Audio visuals, charts. “ “ “ “ “ “

WEEK	General Objectives : 9.0 Understand biological fuel generation in biotechnology.		
	Special Learning Objective:	**TeachersActivities**	**Resources**
	9.1 Explain the process of photosynthesis as the ultimate energy source. 9.2 Describe the nature of biomas i.e plant and animal biomass as sources of carbon for technological processes. 9.3 Explain waste materials as substrate for biotechnological processes. 9.4 Identify the sources of biomass. 9.5 Describe the processes involved in the conversion of biomas to useable fuels e.g combustion, chemical processes aqueous processes etc.	Illustrated lectures “ “ “ “	

WEEK	General Objectives : 10.0 Know the application of biotechnology in agriculture and forestry.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
11 - 12	10.1 Explain plant cell culture. 10.2 List the techniques used in plant cell culture. 10.3 Describe the role of biotechnology in increasing the activities of nitrogen fixing micro organisms in nitrogen fixation. 10.4 Describe the production of microbial insecticides or entomopathogens (bacteria, fungi, viruses) for the control of insect pests. 10.5 Describe the importance of biotechnology in agricultural crop production. 10.6 Describe the role of biotechnology in forestry industries.	Illustrated lectures “ “ “ “ “	Teaching tools “ “ “ “ “

WEEK	General Objectives : 11.0 Understand the role of biotechnology in environmental Technologies.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	11.1 Describe the methods of waste water and sewage treatment.	Illustrated lecture	Audio visuals, charts.
	11.2 Describe the roles of microbes as catalytic agents in geological processes e.g. mineral formation, mineral degradation, sedimentation, weathering, geochemical cycling.	"	"
	11.3 Explain the side effects of microbial involvement with minerals e.g. production of sulpheric acid; production that causes pollution, microbial weathering of limestone etc.	"	"
	11.4 List the beneficial effects of microbes in environmental technology.	"	"
	11.5 Explain waste materials as substrate for biotechnological processes.	"	"
	11.6 Identify the agricultural wastes/by-products that serve as substrate for biotechnological processes.	"	"
	11.7 Explain forestry wastes/by-products as substrate for biotechnological processes.	"	
	11.8 List industrial by-products/wastes that are substrates for biological processes.	"	

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
5-6	Identify experimentally microorganism used in biotechnological processes	Conduct practical on microorganism identification for biotechnological processes	Microscopes, culture media

PROGRAMME:	BIOCHEMISTRY HIGHER NATIONAL DIPOMA
COURSE:	TISSUE BIOCHEMISTRY
CODE:	STH 421
DURATION:	60Hours/ 14 Weeks Lecture=1 Tutorial=0 Practical=3
UNIT:	3.0
GOAL:	This course is designed to provide diplomates with understanding of the Biochemical functions of various tissues and membrane.
GENERAL OBJECTIVES:	On completion of this course, diplomates should be able to: 1.0 Understand the structure and functions of biological membranes. 2.0 Understand the structure, functions and mode of action of excitable membranes,tissues and sensory systems. 3.0 Know the biochemistry of muscle tissue and cell morality.

PROGRAMME: **HND BIOCHEMISTRY**			
Course: Tissue Biochemistry	**Course Code: STH 421**	**Contact Hours: 60 Hours** 1-0-3	
Course Goal: This course is designed to provide with an understanding of the biochemical functions of various fuscous and membrane.			
WEEK	**General Objectives: 1.0 Understand the structure and functions of biological membranes.**		
	Special Learning Objective:	**Teaching Learning Activities**	**Resources**
	1.1 Describe the structure of membrane as organized assembles constituting of proteins and lipids, that separate cells from the environment. 1.2 List the common features of biological membrane. 1.3 Explain phospholipids as the major class of membrane lipids. 1.4 Explain the formation of bilayers by phospholipids and glycolipids. 1.5 Describe the structure of the lipids bilayer. 1.6 Explain that lipid bilayer are permeable to ions and polar molecules. 1.7 Explain the role of proteins in membrane processes. 1.8 Reconstituting functional membrane in the laboratory.	Explain the structure of membrane as a organized assembles constituting protein and lipids that separate cell from the environment. Describe the common features of biological membranes. Lecture and describe the phospholepid as a major class of membrane lipids. Describe the formation of bilayers by phospholipids and glycolipids. Lecture and discuss the structure of bilayers. Discuss lipid layers permeability to ions and polar molecules. Specify the role of proteins in membrane processes.	

	1.9 Describe the nature of the membranes of the red cell the mitochondrion the plasma 1.10 Describe the fluid mosaic model of the biological membrane. 1.11 Explain the features of membrane fluidity. 1.12 Explain the regulation of flow of ions and molecules between cells by specific membrane transport system. 1.13 Outline the roles of the transport processes. 1.14 Distinguish between active and positive transport. 1.15 Explain the sodium-potassium pump. 1.16 Explain the role of Na+-K+ ATpase as an integral part of the sodium-potassium pump. 1.17 Describe the sodium-potassium as an oligomeric trans-membrane protein. 1.18 Describe a model for the mechanism of Na+-K+ pump. 1.19 List the inhibitors of the Na+-k+ pump.	View cell	Microscope

	1.20 Explain the transportation of calcium by a different Atpase. 1.21 Explain that active transport of sugar is couple to their phosphorylation. 1.22 Describe the ionophores 1.23 (transport anti-biotic). 1.24 Explain the functions of lonophores (transport anti-biotic). 1.25 Describe the methods of membrane isolation.	Lecture and discuss the function of lonophores as a transport antibiotics. Explain the methods of membrane isolation.	

WEEK	General Objectives: 2.0 Understand the Structure, functions and mode of action of excitable membranes, tissues and sensory systems.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
5 - 13	2.1 Distinguish between resting and action potentials in nerve impulse transmission. 2.2Explain that an action potential is generated when the membrane potential is above the thresh value (i.e. from 60 – 40 mV). 2.4 haism of a ction ptentials in membranes. 2.5 Describe the action of tetrad toxin and serotoxins (inhibitors). 2.6 Explain neurotransmitter. 2.7 Classify neurotransmitter substances (e.g. excitable and inhibitory). 2.8 Describe acetylcholines as neurotransmitter. 2.9 Explain how catescholamine and gamma-aminobuty rate (GABA) are also neurotransmitters. 2.10Describe the reactions at synaptic junctions. 2.11Explain butrycholine as an anaesthetic agent. 2.12Define dibucaine number.	Illustrated lectures “ “ “ “ “ “ “ “	

WEEK	General Objectives: 2.0 Understand the Structure, functions and mode of action of excitable membranes, tissues and sensory systems.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
	2.13List excitable receptors that are activated by light. 2.14Describe the structure of the retinal rod cells. 2.15Explain the effects of light on retinal rod cells. 2.16Explain the mode of action of the eye lens. 2.17Explain the biochemistry of visual process. 2.18Explain the causes of cataract and night blindness. 2.18Explain the theories put forward to explain increased vision of some animals subdued light.	“ “ “ “ “ “ “	

WEEK	General Objectives : 3.0 Know the biochemistry of Muscle tissue and cell mortality.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
13 - 14	**Biochemistry of muscle tissue** 3.1 Describe the conversion of chemical energy to mechanical energy in the muscle. 3.2 Identify the different types of muscles. 3.3 Describe the nature and structure of the muscle protein e.g. myoglobin. 3.4 Describe the interaction of thick and thin filaments of the muscle. 3.5 Describe the nature and structure of the thick and thin filaments. 3.6 Describe the structure of myosin content of the thick filament. 3.7 Explain the role of action in ATP age activity. 3.8 Explain with the aid of a diagram the functions of actin and myosin. 3.9 Explain the molecular basis of muscle contraction. 3.10 Explain the sources of energy for muscle contraction. 3.11 Describe phosphocreatine as a reservoir of phosphate bond. 3.12 Describe muscle as a thermodynamic machine. 3.13 Explain the role of glucose, fatty acids and ketone bodies as major fuels for the muscle. 3.14 Explain muscle as the major stone of glycogen. 3.15 Determine the glucose level in the blood and urine.	Illustrated lectures Practical identification in the laboratory. Drawings Illustrated lectures Drawings “ “ “ Illustrations “ “ “ “ “ Lab. Experiment on the glucose.	

WEEK	General Objectives: 3.0 Contd.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
13 - 14	3.13 Explain the role of glucose, fatty acids and ketone bodies as major fuels for the muscle. 3.14 Explain muscle as the major store of glycogen. 3.15 Determine the glucose level in the blood and urine. 3.16 Explain the role of muscle in a storing organism. 3.17 Estimate glucose level in a fasting and fed state.	Illustrations “ Laboratory experiment on the glucose.	

WEEK	PRACTICALS	TEACHEARS ACTIVITIES	RESOURCES
13-14	3.14 Determine experimentally the glucose level in the blood urine	Laboratory experiment of glucose level in blood urine	Sample of blood urine

PROGRAMME BIOCHEMISTRY HIGER NATIONAL DIPLOMA
COURSE FORENSIC BIOCHEMISTRY
CODE STH 422
DURATION 45 hours/14 weeks/lecture = 1 Tutorial =0 Practical = 2
UNIT 2.0
GOAL This course is designed to provide diplomatses with basic knowledge of biochemistry in a forensic science laboratory.

GENERAL OBJECTIVES:

On completion of this course, diplomate should be able to:

1.0 Understand the metabolism of foreign compounds (Xenobiotics) antibody

2.0 Understand analysis of materials of forensic interest.

PROGRAMME: HND BIOCHEMISTRY			
Course: Forensic Biochemistry	**Course Code: STH 422**	**Contact Hours: 45 Hours 1-0-3**	
Course Goal: This course is designed to provide students with basic knowledge of the application of biochemistry in a forensics science laboratory.			
WEEK	**General Objectives: 1.0 Understand the metabolism of foreign compounds (Xenobiotics) antibody.**		
1 – 4	**Special Learning Objective:**	**Teachers Activities**	**Resources**

	Metabolism of foreign compounds in the blood. 1.1 Describe drugs as foreign chemical compounds in the system. 1.2 Classify drugs as acidic, basic and neutral. 1.3 Explain the role of the liver enzymes in foreign compound metabolism. 1.4 Describe the characteristics of foreign compound metabolizing enzymes. 1.5 Explain the role of the smooth Endoplasmic recticulum in foreign compound metabolism. 1.6 Explain the two phases in the metabolism of foreign compounds (phase I and II). 1.7 Explain phase I as involving the modification of the drug via oxidation and reduction reactions.	Illustrative lectures. “ “ “ “ “ “ “ “	Teaching tools. “ “ “ “ “ “

	1.8 Explain Phase II as dealing with the conjugation of Phase I products mainly into water extractable produce e.g. glucoronides, sulphases. Etc. 1.9 Explain how metabolism of a drug may enhance or lower the harmful effect of a drug or make an in nocons compound harmful. 1.10 Explain how the effect (metabolism) of a drug in the system depends on such factors as the structure of the compound route of administration, sex and strain and species of animal, presence of other chemicals, diet etc. 1.11 compound harmful. 1.12 Explain how the effect (metabolism) of a drug in the system depends on such factors as the structure of the compound route of administration, sex and strain and species of animal, presence of other chemicals, diet etc. 1.13 compound harmful. 1.14 Explain how the effect (metabolism) of a drug in the system depends on such factors as the structure of the compound route of administration, sex and strain and species of animal, presence of other chemicals, diet etc. 1.15 Explain the terms: toxicity, carcinogen city, mutagenicity detragenicity etc.	Illustrative lectures. “ “ “ “ “	Teaching tools. “ “ “ “ Audio visual

WEEK	General Objectives : 1.0 Understand the metabolism of foreign compounds (xenobiotics) antibody.		
5 - 7	**Special Learning Objective:**	**Teachers Activities**	**Resources**
	1.16 Explain the effects of drugs on tissues in terms of 1.11 above. 1.17 Describe the various routes of excretion of drugs and their metabolites (breakdown produces) e.g exhaled air, sweat, saliva, urine, bile and other body fluids. 1.18 Explain the importance of the study of rate of urinary excretion of drugs in forensic science. 1.19 Explain the importance of the study of rate of urinary excretion of drugs in forensic science. 1.20 Explain drug-drug interactions in the body. 1.21 Extract drugs from biological tissues. 1.22 Monitor contaminants in foods and beverages. 1.23 Identify drugs using TLC, U.V. & I.R. spectroscopy. 1.24 Type blood stains and other blood stains. 1.25 Carry out test on blood stains l(dried and fresh).	Illustrate lecture “ “ “ Urine analysis on drug administration. Practical extraction. Food test. Carry out analysis of drugs using TLC, UV, and IR. Carry out analysis on blood group,	Teaching tools “ “ “

PROGRAMME: HND BIOCHEMISTRY			
Course:	**Course Code:**	**Contact Hours**	
WEEK	**General Objectives:2.0Understand Analysis of Materials of forensic interest.**		
8 - 9	**Special Learning Objective:**	**Teachers Activities**	**Resources**
	<u>Materials of Forensic interest</u> 2.1 Explain forensic science. 2.2 Describe the collection , preservation and forwarding of materials of forensic interest to the laboratory. 2.3 Explain the need for proper storage of materials for forensic analysis. 2.4 Explain the importance of preserving some portions of a sample for further reference. 2.5 Describe the duties of the toxicologist. 2.6 Describe the various groups of poisons. 2.7 Explain the methods of extraction and identification of compounds of forensic interest. 2.8 Describe the extraction and identification of poison and drugs. 2.9 Explain metallic poisoning, indicating where they are deposited in the body. Extract poison from a formulated sample	Illustrate lectures. “ “ “ “ “	Teaching tools. “ “ “
WEEK	General Objectives : 1.0 Understand the metabolism of foreign compounds (xenobiotics) antibody.		
10 - 11	**Special Learning Objective:**	**Teachers/Learning Activities**	**Resources**
	2.10Describe the methods of extraction and specific identification of 2.9 above. 2.11Describe blood groups and rhesin factors. 2.12Carryout blood group typing tests, explain blood group typing.	Illustrative lecture. Practical spot tests on metallic poisoning. Practical blood group test.	

WEEK	General Objectives : 2.0 Contd.		
12 - 14	**Special Learning Objective:**	**Teachers/Learning Activities**	**Resources**
	2.13Explain parentage dispute. 2.14Describe the use of blood group in 2.13 above. 2.15Describe the various types of body fluids. 2.16Describe qualitative methods of identification of blood strains, urine and saliva. 2.17Describe various presumptive (preliminary) tests employed on body fluids (e.g. blood; saliva, semon) before specific conformatory tests. 2.18Explain species identification for blood strain. 2.19Carry out test on blood stains, saliva, smina stains and species identification. 2.20Define hard drugs. 2.21Classify hard drugs. 2.22Describe spot test for drugs of forensic interest. 2.23Describe methods of purification of of such hard drugs. 2.24Describe standard confirmatory methods of analysis of hard drugs. 2.25Carry out qualitative test on different drugs.	Illustrative lecture “ Urine analysis on drug administration Practical extraction. Carry out analysis on saliva.	Teaching tools “ “ “ “

WEEK	General Objectives : 2.0 Contd.		
	Special Learning Objective:	**Teachers/Learning Activities**	**Resources**
	2.26Compare results obtained in 2.23 above with the normal level (data) set by Nigerian standards organization, food and Drug administration (FDA) and World Health Organization (WHO) and similar bodies.	Illustrative lecture	Teaching tools
	2.27Make proper deductions from all available data.	"	"
	2.28Build up result/data banks for future references.	"	"
	2.29Explain presentation pattern of work reports.	"	
	2.30Explain why the analyst must report only his findings.		

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
8-9	2.19 Carry out blood stains Saliva and simian stain and species identification	Carry out analysis on saliva	Saliva
12-14	2.25 Carry out qualitative test on different drugs	Conduct qualitative test on drugs	Drug sample

PROGRAMME: BIOCHEMISTRY HIGHER NATIONAL DIPLOMA
COURSE: INDUSTRIAL BIOCHEMISTRY
CODE: STH 423
DURATION: 60Hours/14Weeks/Lecture = 1 Tutorial = 0 Practicals = 3
UNIT: 3.0
GOAL: This course is designed to provide the diplomate with understanding of industrial Function of biochemist of industry process.

GENERAL OBJECTIVE:

On completion of this course, diplomate should be able to :
Understand mode of action of pesticides resides on tissues and there regarding product
Know general method of isolation and identification of drugs an tissues
Know methods of water analysis treatment and assessment of purity.
Know food toxins then elimination from food tissues.
Understanding the chemical and enzymatic principle of starch conversion and its Industrial application.
Understanding the chemical and enzymatic principles of starch conversion and it Industrial application the quality control methods in the industry.
Understand
Understand general methods of preservation process in food industry.

PROGRAMME: HND BIOCHEMISTRY			
Course: Industrial Biochemistry	**Course Code: STH 423**	**Contact Hours 60 Hours 1-0-3**	
Goal: This course is designed to provide the student with an understanding industrial function of biochemist of industry process.			
WEEK	**General Objectives: Understand mode of action of Pesticides residues on tissue and their degradation product.**		
1 – 2	**Special Learning Objective:**	**Teachers Activities**	**Resources**
	<u>Pesticides</u> 1.1 Explain the term "pesticides". 1.2 List types of pesticides and their chemical structures. 1.3 Describe the biochemical actions of pesticide. 1.4 Illustrate with chemical are actionsthe degradative products of pesticides in the system. 1.5 Describe the biochemical effects of pesticide residues on soil, plant and man. 1.6 Identify and quantify the residues isolated in 1.6 above. 1.7 Compare residues isolated in 1.6 above with control levels set by Nigeria Standard Organisation and food and Drugs Administration. 1.8 Test effects of pesticides on annual tissues.	Lecture. " " " " "	Lecture. " " " "

WEEK	**General Objectives : 2.0 Know General methods of isolation and identification of drug and tissue.**		
	Special Learning Objective:	**TeachersActivities**	**Resources**
	2.1 Describe types of drugs as acidic, basic or neutral. 2.2 Extract drugs from body fluids and tissues. 2.3 Identify and quantify the extracts in 2.2 above. 2.4 State the optional conditions of extraction. 2.5 Test effect of drugs on annual tissues.	Lecture. Demonstrate experiment on drug analysis. Lecture. Demonstrate experiment, the effect of drug on animal tissues.	Drug, animal tissues.

WEEK	General Objectives : 3.0 Know methods of water analysis treatment and assessment of purity.		
3 - 4	**Special Learning Objective:**	**Teachers** **ivities**	**Resources**
	3.1 Describe chemical and physical methods of water analysis for the following constituents, PH, total solid, hardness, chlorides, carbonates, sulphates, lodides, fluorides, nitrates, dissolved oxygen, iron, lead etc. 3.2 Compare data on water samples with acceptable standards. 3.3 Describe methods of reducing the constituents in 3.2. above to acceptable levels. 3.4 Describe other methods of water treatment e.g. filtration, distillation, sedimentation etc. 3.5 Treat impure water to purity by known methods of water treatment.	Lecture. Demonstrate practical on water. Samples. Lecture. Lecture. Demonstrate practical on separation methods.	Visit the water works co-operation.

WEEK	General Objectives : 4.0 Know food toxins and their elimination from food tissues.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
5 - 6	4.1 List types of food toxins. 4.2 Describe the biochemical mode of action of toxin. 4.3 Describe chemical and biochemical methods of isolation and identification of toxins. 4.4 Isolate and identify toxins (exo and endo). 4.5 Compare the levels of toxins with those reported by experts in the field. 4.6 Describe "inoitio" or biochemical mechanisms of detoxification e.g hydrolysis, oxidation, reduction, conjugation etc. 4.7 Explain the role of the liver in detoxification. 4.8 Explain how toxic substances and their products are eliminated after detoxification by the liver through expired air and body fluids. Explain how toxic substances and their products are eliminated after detoxification by the liver through expired air and body fluids.	Lecture. Lecture. Lecture. Demonstrate Practical on Isolation and Identification of toxics. Lecture. Lecture. "	Visit to the medical laboratory technology section of hospitals.

WEEK	General Objectives: 5.0 Understand the chemical and enzymatic principles of starch conversion and it industrial application.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
7 - 8	5.1 Describe the chemical structure and rheological properties of starch. 5.2 Describe enzymatic degradation of starch and starch base products. 5.3 List the industrial applications of starch as raw materials. 5.4 Explain how configuration and conformational state of hydrolytic product of starch govern their industrial uses. 5.5 Explain starch quality in terms of their binding characteristics and amylose/amylopectin ratio. 5.6 List products that potentially can be prepared from starch after enzymatic degration e.g low dextrose syrups, high maltose syrups. 5.7 Describe polymerization and depolymerisation of starch and industrial applications. 5.8 Describe enzymatic isomerisation of corn-based syrups and their application. 5.9 Explain the chemical principles involved in reproduction of starch-based glucose syrups and products. 5.10Produce starch based glucose syrup. 5.11Determine experimentally the quality and rheology of starch (e.g cassava, yam, guinea corn etc).	Lecture. “ “ “ “	**Visit to the breweries industry.**

WEEK	General Objectives: 6.0 Understand the chemical and enzymatic principles of starch conversion and it industrial application.		
	Special Learning Objective:	**Teachers Activities**	**Resources**
9 - 10	6.1 Define the term fermentation. 6.2 Explain the biochemistry of fermentation. 6.3 Describe limited and complete fermentation reactions and their industrial applications. 6.4 Describe commercial (enzyme/yeast) extraction, purification, storage and recovery. 6.5 State the advantage of storage of yeast in the dry form. 6.6 Describe fermentation process in alcohol industry. 6.7 Describe alcoholic fermentation as similar to glycolysis pathway but requires two different enzymatic steps at the end. 6.8 List products of industrial fermentation. 6.9 List products of local fermentation. 6.10 Outline the processes of production of Beer (top and bottom), wine, yeast. 6.11 Describe the role of fermentation in the production of garri, fermented oil bean, palm wine, burukutu.	Lecture. “ “ “ “ Demonstration experimentally. Fermentation reaction. Lecture.	Visit to breweries.

WEEK	General Objectives : 7.0 Understand the quality control methods in the industry.		
	Special Learning Objectives	**Teachers Activities**	**Resources**
11 - 12	7.1 Explain sampling procedure e.g. in food, alcohol and drug. 7.2 Apply biochemical techniques in quality control. 7.3 Analyze by standard methods (both raw and finished products) such constituents as humidity, free and bound water, ash, fibre content, trace elements etc. 7.4 Estimate protein content by kjeldahl method and formal titration. 7.5 Determine carbohydrate, lipid and vitamin contents of various food and beverage items. 7.6 Estimate drugs composition. 7.7 Interpret the significance of results obtained from analyses in 7.2 to 7.6 above. 7.8 Deduce from the results in 7.2 to 7.6 above whether or not they meet set standards.	Lecture “ “ Demonstrate the use of Kjeldahl apparatus in determine protein content. Experiment of drug composition.	Visit to the food industry. Kjeldahl apparatus.

WEEK	General Objectives : 8.0 Understand general methods of Preservation Processes in food Industry.		
	Special Learning Objectives	**Teachers Activities**	**Resources**
13 - 14	8.1 Explain the term “preservation”. 8.2 State preservation methods in food industry. 8.3 Explain the principles of physical and chemical methods of preservation. 8.4 Describe the side effects of chemical and physical methods of preservation of foods. 8.5 Describe the biochemical effects of preservatives on the tissues and organs.	Lecture. “ “ “	

WEEK	PRACTICALS	TEACHERS ACTIVITIES	RESOURCES
1-2	1.8 Test effects on pesticide on annual tissues	Conduct test on the effect of pesticide on annual tissues	Pesticide and annual tissues
3-4	3.2 Compare data on water samples with acceptable standards 3.5 Treat in pure water to purity by knowing method of water treatment		

5-6	3.6 Isolate and identify toxins (Eco and Endo)		
7-8	Determine experimentally the quality and rhea logy of starch (eg cassava, yam, guinea corn etc)	Demonstrate practical on quality and theology of starch	Sample of starch
	7.5 Determine carbohydrate, lipideral vitamins contents of various food and beverage items	Conduct practical to detects the contents of carbohydrate, lipid etc using procreate	Drug sample
	7.6 Estimate drug composition	Equipment of drug composition	

LIST OF BIOCHEMISTRY EQUIPMENT

S/NO	ITEMS	QUANTITY
1	Balances	10
2	Asbestos sheets	50
3	Barometer	2
4	Beehive shelf	6
5	Blowpipe, nickel plated brass	20
6	Test-tube brush	30
7	Centrifuge	2
8	Buster brush	20
9	Bunsen burners	30
10	First aid cabinet	2
11	Clamp for retort stand, die cast aluminum	30
12	Clip, Hofmann's screw	40
13	Combustion boat, porcelain	40
14	Distillation apparatus	5
15	Crucible purcelian with lid	40
16	Electrode, carbon plate with terminal	6
17	Filter pump, nickel plate brass	2
18	Fume boards	2
19	Gauge with ceramic centre	40
20	Gloves, (asbestos and rubber)	10
21	Holder for test tubes	30
22	Kipp's apparatus	1
23	Mortar and pestle	4
24	Oven electric, thermostatic control	1
25	Porous pot	3
26	Printer, tape	2
27	Vacuum pump	1
28	Rack for flasks and test tubes	20 each
29	Rule, I meter	2

30	Khjeldal apparatus	5
31	Spatula	2
32	Polytechnic spheres for modals	20
33	Sphints, wooden	50
34	Retort stand with rod	5 bundles
35	Steam generator	20
36	Steam trap(all glass)	2
37	Magnetic stirrer	2
38	Thermometers	4
39	Tongs	20
40	Tripad	40
41	Voltammeter	2
42	Water bath with rings	4
43	Water still manesty	1
44	Refratometer	1
45	Weighting bottles	20
46	Heating mantle	4
47	Hotplate	4
48	Plastic aspirator	4
49	PH meter	4
50	Portable autoclave	2
51	Muffie furnance	2
52	Thermostated water bath	2
53	Mahler-Cook bump calorimeter	2
54	Vacuum dry oven	1
55	Water deionsar	2
56	Conductivity meter	1
57	Acid shower	1
58	Spectrephezometer-(UV)	2
59	Melting point apparatus	2
60	Wrist type flask shaker	3
61	Soxhlet extraction apparatus	2

62	Colorimeter visual photoelectric	1
63	Flame photometer	1
64	Polarimeter	2
65	Chromatography kits-paper/TLC with spreader for TLC	1
66	Electrophoresis equipment	2
67	Store	1
68	Preparatory room	2

LIST OF PARTICIPANTS

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