

Science Laboratory Technology Chemistry Option - Higher National Diploma (HND)

SECOND YEAR - SECOND SEMESTER

Course: Medicinal Chemistry	2
Course: Physical Chemistry IV (Electrochemistry and Photochemistry).....	12
Course: Natural Products and Stereochemistry.....	20
Course: Food Chemistry and Brewing	28
Course: Forensic Biochemistry	36
Course: Higher Practical Project and Seminar.....	41

Course: Medicinal Chemistry

Department/ Programme: HND Chemistry			
Subject/Course: Medicinal Chemistry	Course Code: STC 421	Credit Hours:	5
Year: Semester:	Pre-requisite:	Theoretical:	2 hours/week
		Practical:	3 hours /week

GENERAL OBJECTIVES:

1. Understand some of the historical background to the discovery and use of drugs
2. Understand basic concepts in the study of drugs and medicines
3. Understand drug action at enzymes
4. Understand drug action at receptors
5. Understand drug action at nucleic acids (DNA and RNA)
6. Understand drug discovery and development
7. Understand pharmacokinetics
8. Describe opium analgesics and their interaction with opiate receptors
9. Describe the discovery and development of transition state inhibitors of HIV-1 protease

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1: Understand some of the historical background to the discovery and use of drugs						
1-2	<p>Students should be able to:</p> <ol style="list-style-type: none"> 1. describe, briefly, the history of opium and its use in medicine 2. describe the isolation and initial medical uses of morphine 3. discuss the elucidation of the structure of morphine 4. understand the simple lock and key mechanism for morphine binding to receptors on the surface of nerve cells 5. discuss the structures and properties of 6-acetyl morphine, 3,6-diacetyl morphine, codeine and dihydrocodeine 6. know the history of some antibacterial agents 7. know that bacteria were first identified by van Leeuwenhoek, associated with disease by Pasteur and Lister and confirmed by Koch 8. understand that Ehrlich initiated chemotherapy 9. describe the discovery of Salvarsan, proflavine and prontosil 10. describe the history of penicillin 11. Know the parts played by Flemming, Florey, Chain and Hodgkins. 	lectures and tutorials	classroom resources	<p>Synthesis of aspirin</p> <p>Synthesis of Paracetamol</p>	guide students	<p>salicylic acid acetic anhydride hydrochloric acid glassware</p> <p>aminophenolacetic anhydride chemicals glassware</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	12. draw the structure of penicillin 13. explain the lability of penicillin 14. use curly arrows to draw the mechanism of the base promoted hydrolysis of penicillin 15. use curly arrows to draw the mechanism of the acid catalysed hydrolysis of penicillin 16. know that penicillin inhibits an enzyme involved in constructing the cell wall of bacteria					
General Objective 2: Understand basic concepts in the study of drugs and medicines						
3	1. Understand that drugs may be classified (a) by their pharmacological effect, (b) by their chemical structure, (c) by their intended target or (c) by their site of action 2. Know basic cell structure 3. know that drugs produce their effects by interacting with proteins (receptors, enzymes, etc) nucleic acids (DNA) lipids (cell membranes) and structural carbohydrates. 4. Understand (revise) the structure of proteins and discuss the interaction of drugs with receptor binding sites. 5. Describe receptor recognition and binding of drugs in terms of: specificity, complementarity of shape, complementarity of electronic nature and the types of binding forces available 6. Explain stereospecificity in drug-receptor binding			Synthesis of Barbituric acid		Chemicals Glassware

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 3: Understand drug action at enzymes						
4 - 5	1. Understand (revise) chemical catalysts and catalysis 2. Understand (revise) enzymes as catalysts 3. Understand (revise) enzyme kinetics 4. Describe substrate binding by enzymes 5. describe molecular mechanism of catalysis for an enzyme 6. discuss competitive inhibitors 7. discuss non-competitive (irreversible) inhibitors 8. understand non-competitive, reversible (allosteric) inhibitors 9. discuss the catalytic role of enzymes in terms of substrate binding, molecular mechanisms of catalysis (general acid/base, nucleophilic groups, transition state stabilisation) 10. Give examples of enzyme inhibitors as antibacterial drugs 11. Give examples of enzyme inhibitors as antiviral drugs 12. Give examples of enzyme inhibitors against the body's own enzymes			Synthesis of Sulphanilamide (2 week project)		Chemicals Glassware

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 4: Understand drug action at receptors						
6	1. Students should be able to: understand what receptors are and what they do 2. describe some neurotransmitters and hormones 3. know that receptor binding induces conformational change which brings about a biological effect 4. describe ion channels and their control 5. describe the activation of membrane bound enzymes describe how a receptor may change its shape upon binding its ligand 6. discuss the design of agonists as drugs 7. describe the binding of agonists in terms of structure, shape and electronic nature 8. discuss the design of antagonists 9. describe antagonists acting at the binding site 10. describe antagonists acting outwith the binding site 11. discuss partial agonists and inverse agonists 12. describe desensitisation and sensitisation 13. discuss tolerance and dependence 14. know that there are cytoplasmic receptors 15. understand receptor types and subtypes			Synthesis of Benzocaine		chemicals Glassware

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 5: Understand drug action at Nucleic acids (DNA and RNA)						
7	1. Understand (revise) the primary secondary and tertiary structure of DNA 2. describe the action of intercalating agents 3. describe the action of alkylating agents 4. draw the structures of: nitrogen mustard and outline its cross-linking of DNA 5. draw the structure of cisplatin and outline its cross linking of DNA strands 6. describe the action of "cutting" agents 7. understand the structures of t-RNA, m-RNA and r-RNA 8. describe the action of drugs on RNA 9. discuss drugs related to nucleic acid building blocks 10. draw the structures of acyclovir and AZT and briefly describe their mechanisms of action			Synthesis of Oil of Wintergreen		Salicylic acid methanol etc
General Objective 6: Understand drug discovery and development						
8 - 9	1. Discuss the screening of natural products to find new drugs 2. describe the exploitation of medical folklore 3. describe the screening of synthetic "banks" of compounds 4. discuss starting from a known ligand such as a			Resolution of alpha-phenethylamine		racemic alpha-phenethylamine (+)-tartaric acid etc

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	<p>hormone</p> <p>5. discuss the role of serendipity and the prepared mind</p> <p>6. understand the saying that "drugs are discovered in the clinic"</p> <p>7. discuss structure-activity relationships and the binding role of: hydroxyl groups, amino groups, aromatic rings, double bonds, carbonyl groups, and amides</p> <p>8. define isosteres and give examples</p> <p>9. discuss drug design to: increase activity, reduce side-effects, improve pharmacokinetics (absorption, metabolism and excretion), improve synthesis and factory production</p> <p>10. discuss the variation of substituents in drug development</p> <p>11. discuss chain extensions and contractions</p> <p>12. discuss ring expansions and contractions</p> <p>13. discuss isosteric replacements, discuss rigidification of the structure</p>					
General Objective 7: Understand pharmacokinetics						
10 - 11	<p>1. Outline how drug uptake, distribution, metabolism and excretion affect the ability of a drug to reach its target</p> <p>2. discuss the design of drugs to influence their: chemical stability and metabolic stability</p> <p>3. discuss drug design to optimise distribution by</p>			Synthesis of a variety of semi-synthetic penicillins		6-amino penicillanic acid a variety of acyl chlorides etc

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	<p>changing the balance of: hydrophobicity, hydrophilicity, charge, polarity</p> <p>4. discuss the design of drugs to confer resistance to chemical hydrolysis and metabolic transformations</p> <p>5. describe some methods of targeting drugs to their site of action</p> <p>6. describe some examples of prodrugs and how they work</p> <p>7. discuss common methods of administration of drugs</p> <p>8. discuss the formulation of drugs</p>					
General Objective 8: Describe opium analgesics and their interaction with opiate receptors						
12 -13	<p>1. Describe the development of narcotic analgesics as an example of traditional medicinal chemistry</p> <p>2. describe the isolation of morphine</p> <p>3. discuss the structure and properties of morphine</p> <p>4. discuss structure-activity relationships of morphine</p> <p>5. discuss variation of substituents</p> <p>6. discuss simplification and dissection</p> <p>7. describe rigidification</p> <p>8. discuss extension of the molecule</p> <p>9. Discuss receptor theories of the opium analgesics</p>			<p>thiamine catalysed formation of benzoin from benzaldehyde</p>		<p>thiamine benzaldehyde, other chemicals</p> <p>Glassware</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	(Beckett-Casy Hypothesis and multiple receptor theories) 10. describe agonists and antagonists 11. describe the discovery of enkephalins and endorphins.					
General Objective 9: Describe the discovery and development of transition state inhibitors of HIV-1 protease						
14 - 15	1. Understand (revise) the mechanism of pepsin catalysed hydrolysis of peptide bonds. 2. Understand (revise) the mechanism of pepstatin inhibition of the catalysed hydrolysis 4. Describe the extensions of these results to the design and investigation of transition state analogue inhibitors for other aspartyl proteases such as Renin 5. Describe the appearance of a new disease, AIDS, in the late 1970 - early 1980s 6. Describe the discovery of the HIV virus in Paris by Luc Montagnier in 1983 7. Describe the discovery of the enzyme HIV-1 protease, its function and mechanism of action describe the design of transition state analogue inhibitors for HIV-1, their structures, mechanism of action, advantages and disadvantages 8. describe the development of improved analogues leading up to the drugs used in the clinic such as: Saquinavir, ritonavir, Indinavir, nelfinavir and Amprenavir.	lectures and tutorials	Classroom resources	Inhibition of enzyme catalysis by small molecule inhibitors	Guide students	suitable enzymes e.g. pepsin, chymotrypsin, phosphatase and their substrates and inhibitors

Assessment:

10% Test 40% Practical, 50% Exam

Textbooks:

Graham L. Patrick, An introduction to medicinal chemistry (3rd edition) Oxford University Press, 2005

A. Wlodawer and J. Vondrasek, Inhibitors of HIV-1 protease: a major success of structure assisted drug design. Annu Rev Bioph Biom vol 27 (1998) pages 249-284.

Course: Physical Chemistry IV (Electrochemistry and Photochemistry)

Department/ Programme: HND Chemistry			
Subject/Course: Physical Chemistry IV (Electrochemistry and Photochemistry)		Course Code: STC 422	Credit Hours: 5
Year: Semester:	Pre-requisite:	Theoretical:	2 hours/week
		Practical:	3 hours /week
GENERAL OBJECTIVES:			
1. Understand the behaviours of ions in solution			
2. Understand the nature of electrochemical cells			
3. Understand the phenomenon of ion transport and molecular diffusion.			
4. Understand photochemical reactions			

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1:0 Understand the behaviours of ions in solution.						
1	<p>1.1 Define the following - activity, activity coefficient and the mean activity coefficient of ions in solution.</p> <p>1.2 Describe the ionic atmosphere.</p> <p>1.3 State the role of ionic atmosphere in determining the value of the mean activity coefficient.</p> <p>1.4 State the form of a shielded coulomb potential.</p>	<p>Explain and illustrate with relevant examples.</p> <p>“</p> <p>“</p> <p>“</p>	<p>Classrooms resources</p> <p>“</p> <p>“</p> <p>“</p>	<p>Determination of thermodynamic solubility product and mean activity coefficient of silver acetate</p>	<p>Provide the laboratory manual</p> <p>- Prepare 40cm³ 0,0.1, 0.3,0.5, 0.75 1mol/dm³ potassium nitrate.</p> <p>- Provide silver acetate salt, standard ammonium thiocyanate solution for titration</p> <p>- Iron (iii) ammonium sulphate as indicator</p>	<p>Boiling tubes</p> <p>Weighing balance</p> <p>Stoppers for the tubes</p> <p>Thermometer</p> <p>Filtration apparatus</p> <p>Pipettes</p> <p>Burettes</p> <p>Beakers</p>
2	<p>1.5 Define ionic strength.</p> <p>1.6 State and derive the Debye-Huckel limiting law for the mean activity coefficient.</p> <p>1.7 Explain how the Debye-Huckel limiting law may be extended to more concentrated solutions.</p> <p>1.8 Define the electrochemical potential of an ion.</p>	<p>Derive the Debye-Huckel limiting law and ask students to do so.</p> <p>Lecture</p> <p>“</p> <p>“</p> <p>“</p>	<p>Classroom resources</p> <p>“</p> <p>“</p> <p>“</p>	<p>Measurement of potential difference generated by electrochemical cells.</p>	<p>Provide the manual</p> <p>Prepare 1 mol/dm³ copper sulphate,</p> <p>1mol/dm³ zinc sulphate</p> <p>0.1/mol/dm³ silver nitrate</p> <p>Saturated 3mol/dm³potassium nitrate</p>	<p>Safety spectacles, copper foil zinc foil</p> <p>Silver wire</p> <p>Emery paper</p> <p>50cm³ beakers</p> <p>Connecting leads</p> <p>Crocodile clips</p> <p>Filter paper</p> <p>Voltmeter</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
3-4	<p>1.9 Derive an expression for the potential difference across an interface in terms of the standard potential difference and the activity of ions.</p> <p>1.10 Derive an expression for the potential difference across a gas/inert metal electrode.</p> <p>1.11 Derive an expression for the potential difference across a metal/insoluble salt/ion electrode.</p> <p>1.12 Describe the construction of metal/insoluble salt/ion electrode.</p> <p>1.13 Derive an expression for the potential difference at a redox electrode (oxidation potential).</p> <p>1.14 Obtain Ecell from data using the expression in 1.14 above.</p>	<p>Lecture and give assignment.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>“</p> <p>“</p> <p>“</p> <p>“</p>	Determination of transport number of ions by molar conductivity measurements	<p>Provide the laboratory manual</p> <p>- Prepare 1mol/dm³ potassium hydroxide {to be diluted by students to 0.35,0.5, 0.6,0.8 mol/dm³}</p>	<p>100cm³ volumetric flasks</p> <p>De-ionised water</p> <p>Pipettes</p> <p>Burettes</p> <p>Conductivity meter</p> <p>Beakers</p>
5-6	<p>1.15 Describe the formation of a liquid junction potential.</p> <p>1.16 Derive an expression for the potential difference across a membrane.</p> <p>1.17 Describe the construction of a cell with a liquid junction and a cell without a liquid junction.</p>	<p>“</p> <p>“</p> <p>“</p>		Determination of dissociation constant and Gibbs free energy by conductivity measurement	<p>Provide the laboratory manual</p> <p>- Prepare 1mol/dm³ potassium hydroxide to be diluted by students to different concs. 0.8 - 0.1mol/dm³</p>	<p>100cm³ volumetric flasks</p> <p>Do ionised water</p> <p>Measuring cylinder</p> <p>Conductivity meter</p> <p>Beakers</p> <p>-Pipette</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 2:0 Understand the nature of electrochemical cells.						
7	<p>2.1 Define thermodynamic reversibility of an electrochemical cell.</p> <p>2.2 Define electrode potential and describe the sign convention.</p> <p>2.3 Relate the e.m.f of a cell to the spontaneous direction of change of the cell reaction.</p> <p>2.4 Define the term standard e.m.f.</p> <p>2.5 Derive the Nernst equation for the concentration dependence of the e.m.f. of a cell.</p>	<p>Explain and illustrate with relevant examples. Ask students relevant questions to determine their learning outcome.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Classroom resources</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Investigation of the effect of changes in silver ion concentration on the potential of the silver electrode</p>	<p>Provide the lab. Manual</p> <p>Prepare 3mol/dm³ potassium nitrate 1mol/dm³ copper sulphate silver nitrate solutions (0.1 - 0.000 1mol/dm³ apparatus for the cell:</p> <p>Cu(s) /cu⁺² 1.0mol/dm³: Ag⁺ xmol/dm³/Ag(s)</p>	<p>safety spectacles</p> <p>Copper foil</p> <p>Silver wire</p> <p>Beakers (50cm³), strips of filter paper</p> <p>Voltmeter (high resistance)</p> <p>Connecting leads</p> <p>Crocodile clips</p>
8	<p>2.6 Relate the standard e.m.f. to the equilibrium constant of the cell reaction.</p> <p>2.7 Describe the method of measuring standard electrode potentials.</p> <p>2.8 Describe the measurement of activity coefficients.</p>	“		<p>Determination of the corrosion profile and susceptibility of Aluminium in two types of environment (NaCl and H₂ SO₄)</p>	<p>Provide the lab manual</p> <p>Demonstrate the experiment</p> <p>-Provide sodium chloride solution, sulphuric acid.</p>	<p>Ammeter</p> <p>Aluminium plates</p> <p>-1000cm³ beaker</p> <p>Nitrogen gas</p> <p>Delivery tubes electrodes</p> <p>Potentiometer</p>
9	<p>2.9 Relate the temperature dependence of the e.m.f. to the entropy of a cell reaction.</p> <p>2.10 Define solubility product and</p>	<p>Lecture</p> <p>“</p>	<p>Classroom resources</p>	<p>Determination of the rate constant and energy of activation of the saponification of ethyl acetate by conductivity</p>	<p>Provide the manual</p> <p>Prepare 0.02 mol/dm³ of ethyl</p>	<p>100ml/volumetric flask</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	deduce its value from e.m.f. data. 2.11 Describe the electrochemical basis of a potentiometric titration. 2.12 List the applications of electrochemistry e.g. corrosion, protection etc.	“ “		measurement.	acetate. 0.02mol/dm ³ of sodium hydroxide	Thermostat (30 ⁰ c) Stopwatch Conductivity mater Measuring cylinder Beakers (250cm ³) Conical flasks (250cm ³) Thermometer
General Objective 3:0 Understand the phenomenon of ion transport and molecular diffusion.						
10	3.1 Define conductivity and molar conductivity of solutions. 3.2 Explain how conductivity and molar conductivity of solutions can be measured. 3.3 State Kohlrausch's law of independent migration of ions. 3.4 Calculate the molar conductivity of a solution using 3.4 above. 3.5 State Oswald's dilution law. 3.6 Use 3.6 to calculate the molar conductivity of weak electrolytes	Lecture “ “ Lecture and conduct tutorials “ “ “ “	Classroom resources “ “ “ “ “ “	Investigation of the replacement of metallic copper by silver ions	Prepare and provide manual for the exp. - Prepare 0.1mol/dm ³ silver nitrate solution	100cm ³ beaker Copper wire Sand paper Test tubes Balance Stop watch Filter paper Watch glass Wash bottle

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	<p>using Oswald's dilution law.</p> <p>3.7 Define the drift velocity and the mobility of ions.</p> <p>3.8 Relate molar conductivity to ion mobility.</p> <p>3.9 Define the transport number of an ion.</p>					<p>Bunsen</p> <p>250cm³</p> <p>Conical flasks</p>
11	<p>3.10 3. List the factors that affect the mobility of ions.</p> <p>3.11 State the basis of the Debye-Huckel - Onsager equation.</p> <p>3.12 Define a thermodynamic force.</p> <p>3.13 Derive the diffusion equation and use it to describe the diffusion of a solute into a solvent.</p>	<p>Explain and illustrate with appropriate examples.</p> <p>“</p> <p>“</p>	<p>Classroom resource</p> <p>“</p> <p>“</p>	<p>Measure the transport number of an ion.</p>	<p>provide lab manual</p> <p>Guide students during the laboratory</p>	<p>Conductimeter</p>
General Objective 4:0 Understand photochemical reactions.						
12	<p>4.1 Explain the influence of light on chemical system.</p> <p>4.2 Define quantum yield efficiency.</p> <p>4.3 Calculate the quantum yield efficiency of a photochemical reaction from a given data.</p>	<p>Lecture</p> <p>“</p> <p>“</p>	<p>Classroom resources</p> <p>“</p>	<p>Construction of a calibration curve for quinine</p>	<p>Provide:</p> <p>0.05mol/dm³ sulphuric acid standard solutions of quinine</p> <p>Demonstrate the operation of the fluorimeter</p>	<p>Fluorimeter or spectro-fluorimeter</p> <p>Balance volumetric flasks</p> <p>Measuring cylinder</p> <p>Burette</p> <p>100cm³</p> <p>Beakers</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
13	4.4 Derive rate laws for a given photochemical reaction.	“ “	“ “	Determination of the amount of quinine in samples of tonic water	As above Prepare 1mol/dm ³ of sulphuric acid	As above Bottles of tonic water
14	4.5 Define photo stationary state. 4.6 Define fluorescence, phosphorescence and chemiluminescence. 4.7 State the importance of photosensitized reactions.			Determination of cadmium in drinking water by fluorimetry	varying concs. of cadmium 0.5mol/dm ³ sodium hydroxide Glacial acetic acid.	Balance 95% ethanol 2-(2-hydroxy-phenyl) benzoxazole Hydrated cadmium sulphate Conical flasks (250cm ³) Thermometer
15				Determination of codeine and morphine in dilute sulphuric acid and dilute sodium hydroxide	Provide the lab. Manual 0.05mol/dm ³ sulphuric acid 0.1mol/dm ³ sodium hydroxide - Codeine/ morphine mixture in 0.05mol/dm ³ sodium hydroxide	Sintered glass crucible Buffers Oven Fluorimeter Sodium tartarate Stop watch Ammonium tartarate

Assessment:

Practical work 40%, Continuous Assessment 10%, Semester Examination 50%.

Recommended Textbooks:

Atkins' Physical Chemistry by Peter Atkins and Julio de Paul, published by Oxford University Press 7th Edition 2002

Course: Natural Products and Stereochemistry

Department/ Programme: HND Chemistry			
Subject/Course: Natural Products and Stereochemistry	Course Code: STC 423	Credit Hours:	5
Year: Semester:	Pre-requisite:	Theoretical:	2 hours/week
		Practical:	3 hours /week
GENERAL OBJECTIVES:			
1. Understand the different forms of spatial arrangement of atoms in molecules and differentiate between the various types of stereoisomers			
2. Understand the sources and chemistry of some natural products.			
3. Discuss the extraction of steroids" from yams and their conversion by partial synthesis into medically important steroid drugs			

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1:0 Understand the different forms of spatial arrangement of atoms in molecules and differentiate between the stereoisomer						
1	1.1 Explain the concept of isomerism. 1.2 Explain the following forms of stereoisomerism: (a) conformational isomerism (b) cis-trans isomerism in alkenes (c) enantiomorphism 1.3 Define chirality. 1.4 Explain the interconvertability of conformers and the non-interconvertability of enantiomers (except via chemical reactions)	Lecture and demonstrate to students the various isomers of a compound using molecular models	Chalkboard, chalk. Molecular models	Measure angle of rotation of an optically active compound experimentally.	Direct students to measure the angle of an optically active compound.	Polarimeter, optically active substance.
2	1.5 Explain optical activity of enantiomers. 1.6 Define specific rotation. 1.7 Write equation for calculating specific rotation. 1.8 Describe parameters that affect specific rotation.			Interconversion of Geometric isomers: Isomerisation of maleic acid to fumaric acid		maleic acid, hydrochloric acid, reflux and filtration apparatus melting point apparatus

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	1.9 Define absolute configuration. 1.10 List notations used in absolute configuration.					
3	1.11 Define racemic mixture. 1.12 Explain racemic resolution. 1.13 Explain diastereoisomerism. 1.14 Write the equation for the number of stereoisomers in a given compound.			Isolation of limonene from orange peel		orange peel apparatus for steam distillation water
4	1.15 Describe meso forms. 1.16 List example of meso forms. 1.17 Know that chiral compounds can not be synthesised from achiral compounds 1.18 Know that reaction of a pure enantiomer with an achiral reagent may give rise to a mixture of diastereoisomers in which one diastereoisomer predominates 1.19 Understand that the process involved above may result from steric effects as the reagents interact.			Perform a chemical reaction with retention of stereochemistry: Conversion of L-phenylalanine into L-3-phenyllactic acid.		Fume hood L-phenylalanine NaNO ₂ , sulphuric acid ether hexane glassware etc

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
5	<p>1.20 Discuss the phenethanolamines, their extraction from "Ma Huang" and other species of Ephedra</p> <p>1.21 Discuss the stereochemistries of the various phenethanolamines and their medical uses.</p>			Demonstrate that the syn addition of bromine to a substituted alkene has stereochemical consequences	Guide students in the Reaction of fumarate with bromine and use the melting point of the product to establish that the addition was syn	Fumaric acid, sodium hydroxide, bromine, dichloromethane, hydrochloric acid glassware etc.
General Objective 2:0 Understand the sources and chemistry of some natural products.						
6	<p>2.1 Discuss what chemists mean by the term "Natural Products"</p> <p>2.2 Describe, in brief outline, the history of the exploitation of natural products.</p> <p>2.3 Discuss primary and secondary metabolites</p> <p>2.4 Discuss some of the more important reactions used by nature in constructing natural products (e.g. oxidation, reduction, carbon-carbon bond forming reactions)</p>	Explain and ask relevant questions	Chalkboard, chalk.	Extract natural products from a named plant.	Guide collection of plants from immediate environment and guide extraction	Wheaton soxhlet extractor.
7	<p>2.5 Describe the role of cofactors in the biosynthesis of natural products</p> <p>2.6 Discuss the elucidation of biosynthetic pathways and the use of labelled precursors and metabolites</p> <p>2.7 Describe the biosynthesis of fatty acids</p> <p>2.8 Describe the biosynthesis and importance of prostaglandins and leukotrienes</p>			Characterise the products from above by simple instrumental analysis		Infra-red spectrophotometer, UV spectrophotometer, nuclear magnetic resonance spectrophotometer, mass spectrophotometer.

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
8	<p>2.9 Explain the meaning of alkaloids.</p> <p>2.10 List alkaloids formed from plants and animal tissues.</p> <p>2.11 Design a plan for the extraction of alkaloids from plant sources.</p> <p>2.12 Describe the source, chemical structure, physiological activity and biosynthesis of ephedrine</p> <p>2.13 Discuss the biosynthesis of selected alkaloids from ornithine and lysine</p>	“ “		<p>Extract caffeine from tealeaves (or similar experiment)</p>		
9	<p>2.14 Discuss the biosynthesis and importance of nicotine</p> <p>2.15 Discuss the biosynthesis and importance of the tropane alkaloids and cocaine</p>			<p>Extract alkaloids from cinchona bark (or other source) and identify by using tlc</p>		<p>solvents NaCO₃ mineral acids solvents tlc reagents: Mayer's, Dragendorf's Hager's etc</p>
10	<p>2.16 Discuss the biosynthesis of selected alkaloids from phenylalanine and tyrosine</p> <p>2.17 Discuss the biosynthesis and importance of:reticulene, thebaine, codeine and morphine</p> <p>2.18 Describe the source, chemical structure, physiological activity and biosynthesis of quinine</p>			<p>Continue above experiment</p>		

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
11	<p>2.19 Explain the meaning of Terpenes.</p> <p>2.20 List broad classes of terpenes.</p> <p>2.21 Outline the sources of terpenes.</p> <p>2.22 Discuss the biosynthesis of monoterpenes from mevalonic acid and isopentenyl pyrophosphate</p> <p>2.23 Discuss the import monoterpenes: alpha pinene, and thujone</p> <p>2.24 Discuss the biosynthesis of: Sesquiterpenes, C₁₅; Diterpenes, C₂₀; Triterpenes, C₃₀ and Steroids</p>			Extract terpenes from a named plant.	Ask students to carry out extraction of terpenes from a named plant	Wheaton, soxhlet extractor.
12	<p>2.25 Explain the meaning of steroids.</p> <p>2.26 List the sources of steroids.</p> <p>2.27 Explain the importance of steroids in the synthesis of sex hormones</p> <p>2.28 Describe the characterisation of steroids with reference to dicyclic acetal side chain.</p> <p>2.29 Describe the synthesis of sex hormones from a named steroid.</p>	Lecture	Teaching Tools	Characterise the extracts above by spectroscopic methods - IR, NMR, UV, and Mass Spectrophotometer etc.	Guide students	Spectroscopic methods - IR, Nmr, UV, MS etc.

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
13	<p>2.30 Draw the structures of the following: Testosterone, Progesterone, Estrone, Stillbestrol, Cortocisterone, Aldosterone, Cortisone etc.</p> <p>2.31 Explain the uses of steroids.</p> <p>2.32 Synthesise sex hormones from named steroids</p>	<p>Lecture</p> <p>“</p> <p>“</p>		<p>Carry out of partial synthetic reactions on steroids starting from cholesterol or other inexpensive “steroid” E.g. oxidation of cholesterol to cholesterone and/or epoxidation of cholesterol etc</p>		
General Objective:3.0 Discuss the extraction of sapogenins from yams and their conversion by partial synthesis into medically important steroid drugs						
14	<p>3.1 Discuss the expense of producing steroid drugs by total synthesis</p> <p>3.2 Describe the search for natural sources of steroids from plants (to be used as raw materials for the synthesis of drugs)</p> <p>3.3 Describe the discovery in yams of sapogenins with a "steroid-like" structure</p>			<p>Carry out partial synthetic pathways such as:</p> <p>Bromination cholesterol to give the dibromide followed by conversion into the delta-5-cholestene-3-one and then isomerisation to the delta-4-isomer. etc</p>		
15	<p>3.4 Describe the conversion of diosgenin, by partial syntheses, into progesterone and androstenedione</p> <p>3.5 Describe the conversion of androstenedione into estrone.</p> <p>3.6 Discuss the stereochemistry resulting at centres produced by the above reactions and introduce the concept of stereospecific and</p>					

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	stereoselective reactions. 3.7 Give examples of stereoselective reactions in the organic chemistry of steroids					

Assessment:

Practical work 40%, Continuous assessment 10%, Assessment Examination 50%

Recommended Textbooks:

Chemical Aspects of Biosynthesis, John Mann, Oxford Chemistry primer - Oxford University Press 1994

Organic Chemistry of Drug Synthesis Volume 1, D.Lednicer and L.Mitscher, Wiley, 1977

Course: Food Chemistry and Brewing

Department/ Programme: HND Chemistry			
Subject/Course: Food Chemistry and Brewing	Course Code: STC 424	Credit Hours: 4	
Year: Semester:	Pre-requisite:	Theoretical: 2 hours/week	Practical: 2 hours /week
GENERAL OBJECTIVES:			
1. Understand the major classification of food and food preservation techniques			
2. Know some basic biotechnology of food			
3. Understand the chemical principles and processes involved in beer brewing			

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1: Understand the major classification of food and food preservation techniques						
1	<p>1.1 Classify Foodstuff In terms of origin of raw materials i.e. plant and animal sources.</p> <p>1.2 List the raw material sources e.g. meat, fish and vegetables.</p> <p>1.3 Describe some industries based on 1.2 above.</p> <p>1.4 Describe some industrial processes of Food preservation i.e. freezing, sterilization, curing, canning, drying etc.</p> <p>1.5 Describe industries based on further processing of products above: bread, confectionary, beverages, margarine, dairy products etc.</p> <p>1.6 List some common food additives.</p>	Lecture	Teaching Tools	Apply techniques in the preservation of food.	Guide the students through the preservation techniques	
2	<p>1.7 Classify 1.6 above as colourants, flavours, preservatives, gelling and emulsifying agents, sweeteners etc.</p> <p>1.8 Describe the significance of food additives.</p> <p>1.9 List causes of food spoilage - bacterial, fungicidal via insects and enzyme activity.</p> <p>1.10 Describe ways of prevention of food spoilage freezing, sterilization, drying etc.</p>			Apply methods in controlling browning of foods	Assist the students to carry out the practical	Salts Hot, water

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
3	<p>1.11 Explain the occurrence and significance of browning reactions in</p> <p>1.12 Distinguish between enzymic and non- enzymic browning in foods</p> <p>1.13 Describe the mechanism of browning reactions</p> <p>1.14 Explain the various methods of controlling or inhibiting browning in foods Explain the occurrence of carbohydrates in plant foods</p>			<p>Prepare jam and jelly from different fruits</p> <p>Measure jelly strength</p>		<p>Fruits (Mango, Pawpaw, Pineapple, Guava etc)</p> <p>Sugar</p>
4	<p>1.15 classify the different carbohydrates found in food</p> <p>1.16 Explain the preparation of syrup from invert sugar</p> <p>1.17 Explain the various types of polysaccharides - starch, celluloses, pectic substances, gums and mucilages and their significance in the food industry</p> <p>1.18 Describe the use of carbohydrates as sweeteners and functional ingredients</p> <p>1.19 List the factors influencing the choice of sweetners in the confectionery industry</p>			<p>Determine the gelatinisation temperatures of different carbohydrate foods</p>	<p>Assist the students to carry out the practical</p>	<p>Citric acid</p> <p>Lime</p> <p>Pectin, Juice extractor/ Pulper</p> <p>Refractometer PH meter Gelo meter</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
5	<p>1.20 List & explain the properties of starches</p> <p>1.21 Explain the phenomenon of starch gelatinisation and retro gradation</p> <p>1.22 Explain the significance of starch gelatinisation and retro gradation in food processing</p> <p>1.23 List and explain the properties of carbohydrates</p>			Isolate and identify different amino acids using chromatography		
6	<p>1.24 List and explain the significant properties of amino acids and proteins</p> <p>1.25 Classify proteins found in plant and animal foods</p> <p>1.26 List the main limiting amino acids found in plant and animal foods</p> <p>1.27 Determination of proteins in food</p> <p>1.28 Explain the role of proteins in food processing</p> <p>1.29 List and classify naturally occurring lipids</p> <p>1.30 distinguish between fats and oils</p>			Fractionate and isolate proteins in foods (milk egg, meat, flour, soybeans etc)		

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
7	<p>1.31 Explain the physical and chemical properties of edible fats and oils</p> <p>1.32 Explain the determination of fats and oils in foods</p> <p>1.33 Describe the processing of fats and oils into different foods products</p> <p>1.34 Explain the mechanism of fat rancidity</p> <p>1.35 Explain the causes of fat rancidity and its effect on food quality</p> <p>1.36 Explain the prevention and inhibition of fat rancidity in the food industry</p> <p>1.37 Explain the term reversion of fats and oil and its significance in the food industry</p>			<p>Determine the physical and chemical properties of fats and oils Density,</p> <p>Refractive index, melting point, colour</p> <p>Peroxide value, saponification value, iodine value, TBA value</p>		
8	<p>1.38 Explain the importance of colour in the quality evaluation of foods</p> <p>1.39 Classify various colouring pigments found in food</p> <p>1.40 List permitted colouring matter</p> <p>1.41 Describe the changes in food pigments during cooking and processing</p> <p>1.42 Describe the different methods of measuring colour of foods (Hunter, Munsell and CIE SYSTEMS)</p>			<p>Determine the value of colour from different foods using CIE L* a* b* system</p>	<p>Demonstrate to the students how to read L* a* b* value from the instrument</p>	<p>Colour meter spectro photometer</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
9	<p>1.43 Explain the role of NAFDAC in regulating the food industry.</p> <p>1.44 List the quality control methods applicable to the industry as mostly in-process.</p>			<p>Apply the quality control methods to determine the following in food:</p> <p>Carbohydrates</p> <p>Moisture</p> <p>Fat</p> <p>Protein</p> <p>Trace elements</p> <p>Water soluble vitamins</p> <p>Fibre</p>	<p>Guide the students through the Practical/laboratory application by the listed food</p>	<p>Deep freezer</p> <p>Autoclave</p> <p>Cabinet drier</p> <p>Can seamer</p> <p>Oven</p> <p>Soxhlet apparatus</p> <p>Kjeldahl apparatus</p> <p>Atomic absorption spectrophotometer</p> <p>Spectrofluorimeter</p> <p>Muffle furnace</p>
General Objective 2 Know some basic biotechnology of food						
10	<p>1 Explain the term biotechnology</p> <p>2 Give a brief history of biotechnology</p> <p>3 Explain the significance of biotechnology in the food industry</p> <p>4 List the major enzymes used in food and in the food industry</p> <p>5 Classify the enzymes listed in 6.4</p>			<p>Chemically conjugate enzymes to solid phase and apply to examples from the food industry</p>		

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
11	<p>6 Explain the significance of the various classes of enzymes in the production of food products</p> <p>7 Explain enzyme immobilization</p> <p>8 Explain the application of immobilized enzymes in food industry</p> <p>9 Explain the importance of enzymes in food analysis.</p>					
General Objective 3: Understand the chemical principles and processes involved in beer brewing						
12	<p>3.1 List raw materials use in beer brewing.</p> <p>3.2 State why starch is the useful chemical constituent of the raw materials above.</p> <p>3.3 List local sources of starch for beer brewing.</p> <p>3.4 Describe methods of extraction of starch from the raw materials listed above.</p> <p>3.5 Explain how starch based glucose syrup is produced by the methods above.</p>	Lecture	Teaching Tools	Extract, in the laboratory, starch from a readily available raw material.		

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
13	3.6 Define the term "fermentation". 3.7 List enzymes used in brewing of beer. 3.8 Explain how fermentation of glucose syrup leads to the production of beer. 3.9 Describe limited and complete fermentation reactions.			Prepare, in the laboratory, glucose syrup from starch	Guide the students through the Laboratory production of beer using local raw materials	Starch, yeast, glass ware Fermentation trough Fermenter
14	3.10 List industrial applications of 2.8 above. 3.11 Describe commercial extraction, purification, storage and recovery of enzymes/yeast. 3.12 Outline the processes of production of beer.			Produce beer in the laboratory		
15	3.13 Describe the chemical and biochemical techniques in the quality control of beer.	Laboratory application of the quality control techniques in the laboratory		Apply chemical and biochemical techniques in the quality control of beer	Assist students to carry out laboratory application of the quality control techniques in the laboratory	Refractometer Hydrometer pH meter

Assessment:

Coursework/ Assignments 10%; Practical 40 %; Examination 50%

Recommended Textbooks & References:

Food: The Chemistry of Its Components (3rd Edition), T.P.Coultate, Royal Society of Chemistry, 1996

Ihekoronye, A.I and Ngoddy, P.O. "Integrated Food Science and Technology for the Tropics" Macmillan Publishers, London and Basingstok.

Course: Forensic Biochemistry

Department/ Programme: HND Chemistry			
Subject/Course: Forensic Biochemistry	Course Code: STH 422	Credit Hours:	4 Hours
Year: 2 Semester: 2	Pre-requisite:	Theoretical:	1 hour/week
		Practical:	3 hours /week
GENERAL OBJECTIVES:			
1. Understand the metabolism of foreign compounds (Xenobiotics) in the body.			
2. Understand the analysis of materials of forensic interest.			

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1.0: Understand the metabolism of foreign compounds (Xenobiotics) antibody.						
1 - 3	<p>Metabolism of foreign compounds in the blood.</p> <p>1.1 Describe drugs as foreign chemical compounds in the system.</p> <p>1.2 Classify drugs as acidic, basic and neutral.</p> <p>1.3 Explain the role of the liver enzymes in foreign compound metabolism.</p> <p>1.4 Describe the characteristics of foreign compound metabolizing enzymes.</p> <p>1.5 Explain the role of the smooth Endoplasmic reticulum in foreign compound metabolism.</p> <p>1.6 Explain the two phases in the metabolism of foreign compounds (phase I and II).</p> <p>1.7 Explain phase I as involving the modification of the drug via oxidation and reduction reactions.</p>	<p>Illustrative lectures.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Teaching tools.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Identify drugs using TLC, U.V. & I.R. spectroscopy.</p> <p>Carry out qualitative tests on different drugs.</p>	<p>Assist students to carry out practicals.</p> <p>Guide students to Carry out analysis of drugs using TLC, UV, and IR.</p>	<p>Chemicals drugs solvents tlc equipment spectrometers synthetic urine etc</p>
4 - 6	<p>1.8 Explain Phase II as dealing with the conjugation of Phase I products mainly into water extractable products e.g. glucuronides, sulphates, etc.</p> <p>1.9 Explain how metabolism of a drug may enhance or lower the harmful effect of a drug or make an innocuous compound harmful.</p> <p>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.</p> <p>1.11 Explain the terms: toxicity, carcinogenicity, mutagenicity teratogenicity etc.</p>	<p>Illustrative lectures.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Teaching tools.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>Audio visual</p>	<p>Carry out Urine analyses after administration of different drugs</p>	<p>Urine analysis practical/ extraction.</p>	

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	<p>1.12 Explain the effects of drugs on tissues in terms of 1.11 above.</p> <p>1.13 Describe the various routes of excretion of drugs and their metabolites (breakdown products) e.g exhaled air, sweat, saliva, urine, bile and other body fluids.</p> <p>1.14 Explain the importance of the study of rate of urinary excretion of drugs in forensic science.</p> <p>1.15 Explain drug-drug interactions in the body.</p>	<p>Illustrate lecture</p> <p>“</p> <p>“</p> <p>“</p>	<p>Teaching tools</p> <p>“</p> <p>“</p>	<p>Extract drugs from biological tissues and identify by tlc etc</p>		
General Objective 2.0: Understand Analysis of Materials of forensic interest.						
7 - 9	<p><u>Materials of Forensic interest</u></p> <p>2.1 Explain forensic science.</p> <p>2.2 Describe the collection, preservation and forwarding of materials of forensic interest to the laboratory.</p> <p>2.3 Explain the need for proper storage of materials for forensic analysis.</p> <p>2.4 Explain the importance of preserving some portions of a sample for further reference.</p> <p>2.5 Describe the duties of the toxicologist.</p> <p>2.6 Describe the various groups of poisons.</p> <p>2.7 Explain the methods of extraction and identification of compounds of forensic interest.</p> <p>2.8 Describe the extraction and identification of poison and drugs.</p> <p>2.9 Explain metallic poisoning, indicating where they are deposited in the body.</p>	<p>Illustrate lectures.</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Teaching tools.</p> <p>“</p> <p>“</p> <p>“</p>	<p>Practical extraction.</p> <p>Food test.</p> <p>Monitor contaminants in foods and beverages.</p> <p>Extract poison from a formulated sample</p> <p>Practical spot tests on metallic poisoning.</p>		<p>Contaminated food and beverages, testing materials</p>

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
10	<p>2.10 Describe the methods of extraction and specific identification of 2.9 above.</p> <p>2.11 Describe blood groups and rhesus factors.</p> <p>2.12 Explain blood group typing.</p>	Lecture.		Carry out blood group typing tests	Practical blood group test.	
11 - 12	<p>2.13 Explain parentage dispute.</p> <p>2.14 Describe the use of blood group in 2.13 above.</p> <p>2.15 Describe the various types of body fluids.</p> <p>2.16 Describe qualitative methods of identification of blood stains, urine and saliva.</p> <p>2.17 Describe various presumptive (preliminary) tests employed on body fluids (e.g. blood; saliva, serum) before specific confirmatory tests.</p> <p>2.18 Explain species identification for blood strain.</p> <p>2.19 Carry out test on blood stains, saliva, smina stains and species identification.</p>	Lecture “	Teaching tools “ “	<p>Carry out analysis on blood group,</p> <p>Carry out qualitative identification of blood stains, urine and saliva.</p>		
13	<p>2.20 Define hard drugs.</p> <p>2.21 Classify hard drugs.</p> <p>2.22 Describe spot test for drugs of forensic interest.</p> <p>2.23 Describe methods of purification of such hard drugs.</p> <p>2.24 Describe standard confirmatory methods of analysis of hard drugs.</p>		“	Type blood stains and other stains.		

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
14 -15	2.25 Compare results obtained in 2.23 above with the normal level (data) set by Nigerian standards organization, food and Drug administration (FDA) and World Health Organisation (WHO) and similar bodies.	Illustrative lecture	Teaching tools	Carry out forensic tests on blood stains (dried and fresh)		
	2.26 Make proper deductions from all available data.	“	“			
	2.27 Build up result/data banks for future references.	“	“			
	2.28 Explain presentation pattern of work reports.					
	2.29 Explain why the analyst must report only his findings.					

Assessment:

Give details of assignments to be used:
 Coursework/ Assignments 10 %; Practical 40%; Examination 50%

Recommended Textbooks & References:

- (1) Forensic Medicine by Keith Simpson.
- (2) Introduction to Clinical Chemistry by Derek A. Woodrow.

Course: Higher Practical Project and Seminar

Department/ Programme: HND Chemistry			
Subject/Course: Higher Practical Project and Seminar	Course Code: STC 426	Credit Hours:	9
Year: Semester:	Pre-requisite:	Theoretical: Practical:	1 hours/week 8 hours /week

GENERAL OBJECTIVES:

Students should be able to:

1. Select, with the help of lecturers, a laboratory based topic for investigation.
2. Decide, with the help of a lecturer, on an experimental investigation in that area.
3. Carry out a literature review of the topic, paying particular attention to the area selected for investigation.
4. Prepare a seminar on the proposed investigation
5. Give the seminar and defend the proposed investigation when questioned by the participants in the Seminar
6. Perform, under the supervision of lecturing staff, the experimental investigation over the course of the Semester. Drawing conclusions and making suggestions for developing the research as the work proceeds
7. Write a full project report in scientific format consisting of: (i) A free standing Abstract, (ii) Introduction, (iii) Methods (or Experimental), (iv) Results, (iii) Discussion, (iv) References.
8. Prepare a seminar on the investigation, the results found, the conclusions drawn and proposals for further investigations.
9. Give the seminar and defend the investigation when questioned by the participants in the Seminar

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 1 Select, with the help of lecturers, a laboratory based topic for investigation						
1	<p>Students are able to</p> <ol style="list-style-type: none"> 1. Understand the process of carrying out a research project and seminar. 2. Explain the characteristics of a good project/research investigation 3. List the different components of a research/project work 4. List the factors considered in selecting a project/research problems 5. Select a topic for investigation 	<p>Explain the process by using the general objectives 1-9 above. Provide a list of proposed investigations and help students choose one.</p>	<p>Cooperation of all lecturers, list of topics, classroom resources</p>			
General Objective 2: Decide, with the help of a lecturer, on an experimental investigation in that area						
2	<p>With help from the lecturer students:</p> <ol style="list-style-type: none"> 1. Understand the topic and areas suitable for experimental investigation. 2. Select the area of the topic and design experiments for the investigation 	<p>Discuss the topic and areas for investigation design experiments for the student</p>	<p>Expertise of the Lecturer</p> <p>Desk chairs paper and pen or pencil</p>			

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 3: Carry out a literature review of the topic, paying particular attention to the area selected for investigation						
3	1. Read relevant books and papers 2. Make relevant notes 3. Understand how the proposed investigation complements the existing literature	Check that students understand relationship between existing knowledge and the proposed investigation	Quiet areas for talking			
General Objective 4: Prepare a Seminar on the proposed investigation						
4	1. Students understand how to prepare for presenting a seminar. 2. Students prepare for the seminar	Revise how to prepare a seminar (refer to the Technical English course) and Guide students through their preparation	Classroom and Library	Students begin relevant experiments e.g. analysis, synthesis, measurement, observations, data collection etc		Laboratory resources, glassware, chemicals, meters, instruments spectrometers etc
General Objective 5: Give the seminar and defend the proposed investigation when questioned by the participants in the Seminar						
5	1. Student gives a seminar on the proposed topic 2. Student answers questions from the audience 3. Student adjusts proposed project in light of comments made during the seminar	Attend seminar, ask questions designed to challenge and improve project, note helpful comments from the audience	Seminar room Overhead projector and acetates	Students continue relevant experiments e.g. analysis, synthesis, measurement, observations, data collection etc		Laboratory resources, glassware, chemicals, meters, instruments spectrometers etc
General Objective 6: Perform, under the supervision of lecturing staff, the experimental investigation over the course of the Semester. Drawing conclusions and making suggestions for developing the research as the work proceeds.						
6 - 12	1. Students can work under GLP conditions, keeping notebook and writing up experiments in a second lab notebook (both notebooks hard bound) 2. Students begin to draft their report beginning with the Introduction then methods then results and, at a late stage their conclusions	Advise and Guide students Make sure students are writing up as they go along and begin to write the final report at about week 7.		Students continue experiments and data collection	Guide and supervise students. Review results regularly making sure that students understand them and draw appropriate conclusions.	Laboratory resources, glassware, chemicals, meters, instruments spectrometers etc

Theoretical Content				Practical Content		
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
General Objective 7: Write a full project report in scientific format consisting of: (i) A <u>free standing</u> Abstract, (ii) Introduction, (iii) Methods (or Experimental), (iv) Results, (iii) Discussion, (iv) References						
13	1. Students complete and submit a full project report in the layout of a Scientific report. 2. Students Write an Abstract that stands alone and does not refer to the body of the report 3. Students know the report consists of an Introduction, Methods (or Experimental), Results, Discussion and References. (The Results and Discussion may be combined as Results and Discussion).	Revise how to prepare a seminar (refer to the Technical English course) and Guide students through their preparation				
General Objective 8. Prepare a seminar on the investigation, the results found, the conclusions drawn and proposals for further investigations.						
14	1. Students understand how to prepare for presenting a seminar. 2. Students prepare for the seminar	Revise how to prepare a seminar (refer to the Technical English course) and Guide students through their preparation				
General Objective 9 Give the seminar and defend the investigation when questioned by the participants in the Seminar						
15	1. Student gives a seminar on the proposed topic 2. Student answers questions from the audience	Attend seminar, ask questions	Seminar Room, overhead projector and acetates			

Assessment:

Give details of assignments to be used:
 Seminars 20%; Practical 40 %; Final Report 40%;

Recommended Textbooks & References:

Scientific Journals (particularly reviews)