

NATIONAL BOARD FOR TECHNICAL EDUCATION KADUNA

HIGHER NATIONAL DIPLOMA (HND)

IN

INDUSTRIAL SAFETY AND ENVIRONMENTAL ENGINEERING

CURRICULUM AND COURSE SPECIFICATIONS

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

**HND INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING
YEAR ONE**

SEMESTER ONE

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 301	Use of English III	2	-	-	2	2
2.	MATH 311	Advanced Algebra	2	-	-	2	2
3.	ICT 201	Computer Aided Design & Drafting 1	0	-	3	2	3
4.	GNS 311	Engineer in Society	2	-	-	2	2
5.	CEC 302	Hydrology & Hydrogeology	1	-	2	2	3
6.	IST 311	Safety & Health Management	2	-	-	2	2
7.	IST 313	Ergonomics	2	-	-	2	2
8.	IST 315	Components & Structural Integrity	1	-	2	2	3
9.	EET 311	Environmental Microbiology	2	-	3	3	5
			14	-	10	19	24

SEMESTER TWO

S/No	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	MATH 312	Advanced Calculus	2	-	-	2	2
2.	GNS 413	Industrial Management Psychology	2	-	2	3	4
3.	IST 321	Environmental hazards & Control	2	-	-	2	2
4.	IST 322	Advanced Safety Management	2	-	-	2	2
5.	CEC 202	Water Supply & Sanitary Engineering	2	-	3	3	5
6.	EET 321	Water Chemistry	2	-	3	3	5
7.	EET 322	Microbiological Techniques	2	-	3	3	5
8.	EET 324	Applied Remote Sensing	2	-	-	2	2
			16	-	11	20	27
		<u>ELECTIVES (COMPULSORY)</u>					
		Biological & Chemical	1				
9.	EET 328	Instrumentation	1	-	2	2	3
10.	IST 326	Electrical Safety		-	2	2	3
			18	-	15	24	33

YEAR TWO
SEMESTER ONE (ALL OPTIONS)

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	CEC 421	Environmental & Pollution Control	2	-	3	3	5
2.	IST 411	Radiation Hazards & Protection	2	-	3	3	5
3.	SEC 421	Project & Research Method	1	-	5	2	6
4.	ICT 312	Computer Aided Design & Drafts II	0	0	3	2	3

ENVIRONMENTAL ENGINEERING TECHNOLOGY OPTION

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	CEC 307	Soil Mechanics	1	-	3	2	4
2.	CEC 304	Water and Waste Water Eng. II	2	-	3	3	5
3.	CEC 419	Public Health Engineering	2	-	-	2	2
4.	EET 411	Solid Waste Management	3	-	-	3	3

INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY OPTION

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	IST 412	Advanced Fire Control	1	-	3	2	4
2.	IST 413	Occupational Health & Hygiene	1	-	3	2	4
3.	IST 415	Hazard & Operability Studies	2	-	-	2	2
4.	IST 417	Advanced Accident Prevention	2	-	-	2	2

SEMESTER TWO (ALL OPTIONS)

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	CEC 428	Engineering Management	2	-	-	2	2
2.	MATH 313	Statistical methods	2	-	-	2	2
3.	CEC 407	Foundation Engineering	2	-	-	2	2
4.	SEC 421	Project	-	-	6	3	7

ENVIRONMENTAL ENGINEERING TECHNOLOGY OPTION

S/NO	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	EET 424	Oilfield Water System	2	0	2	2	5
2.	CEC 426	Water and Waste Water Eng'g II	2	1	-	3	3
3.	EET 426	Environmental Protection Admin	2	-	-	2	2
4.	EET 422	Environmental Assessment	2	1	-	3	3

INDUSTRIAL SAFETY ENGINEERING OPTION

S/NO	COURSE CODE	COURSE TITLE					
1	IST 422	Advanced Transportation Safety	2	-	2	3	4
2	IST 426	Machinery and Tools Safety	2	-	-	2	2
3	IST 428	Safety in Metal Works	2	-	3	3	5
4	IST 424	Safety and Risk Management	2	-	-	2	2

PROGRAMME: HND IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: ENVIRONMENTAL MICROBIOLOGY		Course Code: EET 311	Contact Hours: 2-0-3
Course specification: Theory and Practical			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the Nature of Micro-organisms		
1	1.1 Classify microorganisms into main groups. 1.2 State the general characteristics of each group in 1.1 above. 1.3 Explain characterization of micro-organism in the following ways: cultural characterization, microscopic examination, characterization of metabolism, chemical characterization and genetic characterization. 1.4 Explain bacterial nutrition. 1.5 Describe various bacteriological media. 1.6 Describe physical conditions required for bacterial growth. 1.7 Explain reproduction in bacteria and a typical bacteria growth curve. 1.8 Explain physiology and nutrition in fungi. 1.9 Explain cultivation of fungi. 1.10 Explain general control of micro-organisms by physical and chemical agents. 1.11 Observe various cultures of micro-organisms.	By means of chart, show the students a basic classification of microorganisms and a list of characteristics for each group. Explain ways of characterization of micro-organisms. Discuss Bacterial and fungal physiology and nutrition and conditions relevant in cultivation of bacteria and fungi. Describe types of media used in microbiological laboratory. Show a cultures of bacteria and fungi. Discuss physical and chemical methods of controlling micro-organisms, carriers & habitat.	Chalkboard Teacher-made chart, prepared plate cultures of bacteria and fungi.
	General Objective: 2.0: Understand Public Health Microbiology		
	2.1 Explain the terms: pathogens, virulence and infection. 2.2 Describe some common air-borne infections of man and control. 2.3 Describe some food and water borne	Define and distinguish between pathogens, virulence and infection as they relate to diseases. List and discuss common air-borne, food-and waterborne infections of man and control measures. List and discuss local vector-transmitted diseases of man	Chalkboard Samples collected from relevant sites for culturing Petri-plates

	<p>infections of man and control.</p> <p>2.4 Describe some common contact diseases of man and control.</p> <p>2.5 Describe some local vector-transmitted diseases of man and control: malaria, onchocerciasis, schistosomiasis, guinea worm.</p> <p>2.6 Explain the need to control housefly and sewage disposal in public health.</p> <p>2.7 Explain infection potential of swimming places and control.</p> <p>2.8 Culture samples from refuse, pools etc within the town.</p>	<p>and basic control measures.</p> <p>Discuss the role of swimming places in infections of man and control.</p> <p>discuss the significance of housefly and proper sewage disposal in public health.</p> <p>Guide students to culture microorganisms from samples obtained from refuse dumps swimming pools, etc.</p>	<p>Microbiological media.</p>
General Objective: 3.0: Understand the Role of Microbes in Material Degradation			
	<p>1.1 Explain the deterioration by micro-organism of the following materials</p> <ol style="list-style-type: none"> i. food stuffs ii. paper iii. textiles and cordage iv. rubber v. metals vi. paints vii. petroleum products <p>1.2 Explain principles in prevention of microbiological deterioration.</p> <p>1.3 Explain food preservation methods.</p> <p>1.4 Collect samples of waste and observe actions of microbes in its degradation.</p>	<p>Discuss microbial deterioration of the materials listed in (3.1) and explain the principles applicable in material deterioration prevention.</p> <p>List and discuss methods of food preservation.</p> <p>Guide students to observe changes in wastes as microbial degradation takes place</p>	<p>Chalkboard, Samples of wastes.</p>
General Objective: 4.0: Understand the Application of Microbes in Pollution Control			
	<p>1.1 Explain the application of microorganisms in:</p>	<p>Discuss methods involving the application of microorganisms in solid wastes, sewage, industrial waste-</p>	<p>Chalk board, Industrial visit e.g. to composting</p>

	<ul style="list-style-type: none"> i. solid waste recycling and disposal. ii. sewage and industrial waste water treatment. iii. Combating oil pollution problem. 	water and remediation of oil polluted sites.	sites.
General Objective: 5.0: Understand Microbial Interactions in the Environment			
	<ul style="list-style-type: none"> 1.1 Explain types of microbial interactions in nature: competition, mutualism, commensalisms, antagonism, parasitism and predation. 1.2 Describe the relative predominance of microorganisms in batch treatment of an organic waste. 	<p>Define and distinguish, between the terms listed in (5.1) using appropriate illustrations.</p> <p>Discuss changes in microbial genera and species type (i.e. succession) in batch treatment of an organic waste.</p>	Chalkboard

PROGRAMME: HND IN ENVIRONMENTAL AND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE: Environmental Microbiology		Course Code: EET 311	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct Practical to Improve the Theoretical Knowledge of Students		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Identify main groups of microorganisms – viruses, bacteria, protozoa, fungi and algae. 1.2 Observe various cultures of microorganisms. 1.3 Cultivate bacteria in the laboratory. 1.4 Cultivate fungi in the laboratory. 1.5 Prepare culture samples from organic refuse, swimming pool and river/Stream. 1.6 Demonstrate the deterioration by microorganism (bacteria and fungi) of various waste material (e.g. food stuff, paper, wood, petroleum products etc.) 1.7 Apply microorganisms (bacteria/fungi) in solid waste recycling and disposal e.g. composting, Biogas production. 1.8 Apply microorganisms (bacteria) in industrial waste-water treatment. 1.9 Apply microorganism (bacteria) in oil pollution problem on soil. 1.10 Monitor changes in bacterial/fungal pollution on organic wastes during batch treatment.	Technologist to prepare equipment under the supervision of the lecturer . Lecturers to prepare practical manuals. Technologist to monitor students. Technologist to collect reports from student. Lecturer to assess the students.	Equipment required for each practical sets of Apparatus.

PROGRAMME: HND INDUSTRIAL SAFETY AND ENVIRONMENTAL SANITATION			
COURSE: SAFETY AND HEALTH MANAGEMENT		Course Code: IST 311	Contact Hours: 2-0-0
Course specification: Theoretical			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the various systems of the body		
1	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Describe the following systems of the body: <ul style="list-style-type: none"> ■ The respiratory system ■ Digestive system ■ Circulatory system ■ Nervous system ■ Immune system 1.2 Explain the relationship between the different systems.	Explain the systems of the body and their relationship	Chalk, duster and biological charts
2	General Objective 2.0: Knowing and management of contagious diseases		
	2.1 Define What a contagious disease is 2.2 Explain the causes of communicable diseases 2.3 List communicable diseases 2.4 Explain how communicable diseases spread 2.5 Describe the treatment and management of communicable diseases.	Explain contagious diseases and their mode of spread Explain the treatment and management of communicable diseases.	
3.	General Objective 3.0: Know how to apply first aid treatment		
	3.1 Definition of first aid 3.2 Description of first aid management/treatment in each of the following situations: <ul style="list-style-type: none"> - Wounds and bleeding - Drowning 	Define and Explain first aid Explain the first aid treatment and management of various ailments and accidents Explain the methods of transporting injured/ill persons) Explain general health management	Chalk, Duster and Board.

	<ul style="list-style-type: none"> - Shock (Chemical/Thermal/Electric types. - Snake bites - Burns and scalds - Exhaustion (Head) - Dislocation, sprain and strains - Accidents in natural disasters <p>3.3 Explain C.P.R. Treatment</p> <p>3.4 Describe the various methods of transporting the injured/ill person(s)</p> <p>3.5 Explain general health management</p>		
4	General Objective 4.0: Know what occupational health involves		
	<p>4.1 Define occupational health</p> <p>4.2 Explain its development</p> <p>4.3 Explain the medical aspects of occupational health</p> <p>4.4 Explain the basic principles of occupational health management</p> <p>4.5 State and explain the relationship between occupational health and hygiene.</p>	<p>Explain Occupational health and its development.</p> <p>Explain the principles and medical basis of occupational health</p> <p>Explain relationship between occupational health as hygiene.</p>	Chalk and Duster and Board
5	General Objective 5.0 Know how to organize safety programmes		
	<p>5.1 Explain safety programme organization</p> <p>5.2 Describe the basic elements of a safety organization.</p> <p>5.3 Explain the qualities of a good leader/Manager</p> <p>5.4 Explain assignment of responsibilities to top management.</p> <p>5.5 Explain the purpose of safety committees, describe the composition, functions and how to organize meetings.</p>	<p>Explain the concept of safety programme as organization</p> <p>Explain the role of top management, committees in safety organization</p> <p>Explain qualities of good leaderships in organization.</p> <p>Explain the relevance of follow by safety committees.</p>	Chalk and Duster and Board

	5.6 State and discuss the relevance of follow up by safety committee.		
6	General Objective 6.0 Know the procedures involved in job-safety analysis		
	6.1 Define Job-Safety-Analysis 6.2 Describe the following basic steps of a job safety analysis: <ul style="list-style-type: none"> - Selection of job to be analyzed - Breaking job into succession steps - Identifying hazards and potential accidents - Developing solutions to prevent accidents. 6.3 Explain the procedure of a job safety analysis 6.4 Apply procedure to least four different jobs (in oil industry) and two in other allied industries. 6.5 Describe job-instruction. Gave examples.	Explain job safety analysis Explain the procedures/Steps of job-safety analysis Carryout job safety analysis in some oil and allied industries.	Chalk, Duster - Industrial visits

PROGRAMME: Higher National Diploma in Industrial Safety & Environmental Engineering Technology			
COURSE: Ergonomics		Course Code: IST 313	Contact Hours: 2-0-0
Course specification: Theory			
WEEK	GENERAL OBJECTIVE: 1.0 Know the Meaning and Significance of Ergonomics in Industrial Safety		
1	1.1 Define ergonomics and explain its significance	Defines Ergonomics and explains its significance List factors essential in ergonomics	Chalk Chalk board
	1.2 State factors relevant in ergonomics – nature of job, biological capability, body dimensions, acceptable working hours etc.		
General Objective 2.0: Understand Human Biological Systems Essential to Ergonomics			
	1.1 Name parts of the human skeleton and associated muscles for movement	Describe the components of the human skeleton and associated muscles for movement.	Chalk Chalkboard
	1.2 Discuss heart beat, breathing process and oxygen consumption/energy production at rest and at work.	Discuss process essential in ergonomics both at rest and at work.	Charts Skeleton
	1.3 Name the main parts of the central nervous system (CNS) and the peripheral nervous system (sensory and motor nerve)	Describe the nervous system, reflex and voluntary actions	
	1.4 State the pathway of nervous impulse in reflex action and a voluntary action.		
General Objectives 3.0: Understand Ergonomics in Physical Effort Tasks			
	1.1 State the explain the three main types of physical effort tasks – full body dynamic work, localized muscular work, static muscular work.	Describes physical effort tasks and parameters for measurement of physical work. Explain factors that influences parameters for measurement of physical work.	Chalk Chalkboard Charts
	1.2 Discuss parameters for measurement of physical work – oxygen consumption, heart beat rate, blood pressure, body	Assign problems on work rest cycles and recovery time formula to students to solve. Explains biomechanical factors and causes of disability	

	<p>temperature, sweat rate.</p> <p>1.3 Explain in factors influencing results in 3.2 such as sex, age, environment, etc.</p> <p>1.4 Explain work and rest cycles, recovery time formula and its importance in rest pauses during physical effort tasks.</p> <p>1.5 Explain biomechanical factors in work and some causes of disability of biomechanical origin.</p>	of biomechanical origin.	
General Objective 4.0: Know the Effects of Environment on Performance in Physical Work			
	<p>1.1 Explain the effect of heat on performance at work.</p> <p>1.2 State factors which influence gain or loss heat – ambient temperature, relative humidity, air velocity, radiant heat.</p> <p>1.3 Discuss anti action of heat load – length of time a man carryout a specific task in a particular thermal environment.</p> <p>1.4 Explain heat stress index and the basis.</p> <p>1.5 Discuss reduction of heat stress in a work environment.</p>	<p>Explains how heat can affect work performance</p> <p>Describes factors that influence gain or loss of heat.</p> <p>Gives the formula for heat stress index and ask students to determine the heat stress index of the environment.</p> <p>Discuss the control of heat stress in the work environment.</p>	<p>Chalk</p> <p>Chalkboard</p> <p>Charts</p>
General Objective 5.0: Understand Ergonomics in Psychomotor Tasks			
	<p>1.1 Define psychomotor tasks and list distinguishing features and examples of psychomotor tasks e.g. automobile driving.</p> <p>1.2 Describe task evaluation in psychomotor tasks.</p> <p>1.3 Explain the effects of excessive standing and excessive sitting in tasks and the remedy.</p>	<p>Explains Psychomotor tasks and enumerates distinguishing features.</p> <p>Describes task evaluation.</p> <p>Ask students to compare and contrast the effects of excessive standing and sitting in tasks and their remedies.</p>	<p>Chalk</p> <p>Chalkboard</p>

General Objective 6.0: Understand Ergonomics in Visual Inspection Tasks		
<p>6.1 State the meaning of visual inspection tasks and the two main categories – acceptance inspection and process control.</p> <p>6.2 State factors significant in the design of inspection tasks – vision and illumination, sensory memory, psychological and social factors.</p> <p>6.3 Explain factors that influence detecting and discrimination of signal characteristics in human vision during inspection tasks – niuty glare, age etc.</p> <p>6.4 Explain the psychological factors of training alertness, perceptual organization, learning and motivation in effectiveness in visual inspection tasks.</p> <p>6.5 Discuss conditions for good visual inspection task design – lack of ambiguity, work done small loots, adequate time etc.</p>	<p>Explains Visual Inspection Tasks and categories. State factors significant in the design of inspection tasks. Describe factors that influence the detection and discrimination of signal characteristics. Explain psychological factors that influences effectiveness of visual inspection tasks. List condition for good visual inspection task design.</p>	<p>Chalk Chalkboard</p>
General Objective: 7.0: Know Workplace Design in Ergonomics		
<p>7.1 Explain a good workplace design in relation to operator efficiency and safety.</p> <p>7.2 Define Authrepometry and state the main authropometric dimensions necessary for the design of workplaces in regards to sitting and standing postures.</p> <p>7.3 Explain the meaning and significance of working surface and state dimensions of working surface for males and females.</p> <p>7.4 Explain the meaning and significance of working envelope and state dimensions for</p>	<p>Explains a good workplace design Explains Anthropometry and anthropometric dimensions for workplace design. Explains the meaning and significance of</p> <ul style="list-style-type: none"> - work envelope - workplace height - footrest and foot pedals <p>Discuss types of chairs in particular jobs and acceptable chair dimensions.</p>	<p>Chalk Chalkboard Charts</p>

	<p>right hand side of the maximum working envelope for males and females.</p> <p>7.5 Explain the meaning and significance of workplace height and describe the design dimensions of a sit-stand, standing, and sitting workplaces.</p> <p>7.6 Explain the significance of and state good design parameters of footrests and footpedals.</p> <p>7.7 Discuss selection of fixed or swivel chairs in particular jobs and state the generally acceptable chair dimensions in relations to industrial population.</p>		
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PROGRAMME: HND IN ENVIRONMENTAL AND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE: Component and Structural Integrity.		Course Code: IST 315	Contact Hours 1- 0 - 2
Course Specification: Theoretical and Practical Content			
WEEK	General Objective: 1.0 Understand basis of Engineering design – the Tensile Test.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Describe the various forms of stress. 1.1 State the formulae for calculating. <ul style="list-style-type: none"> - tensile stress - compressive stress - shear stress - strain. 1.2 Explain how a component of a materials can be under strain. 1.3 Define Hooke’s law 1.4 Explain the significances of: <ul style="list-style-type: none"> - yield stress - ultimate tensile stress. 1.5 Discuss methods for determining margin of spare capacity.	Ask the students to describe Various forms of stress and use formula to calculated them. Ask students to define Hook’s law and its applications. Discuss methods of determining margin of spare capacity.	Spring with a pan, Different weights. Chalk and Chalk Board.
	General Objectives 2.0: Understand the Technical Modes of Failure of Structural Components.		
	2.1 List the various modes of failure of structural components (e.g. ductile, Buckling, Brittle facture, Creep, wear, metal fatigue and Corrosion). 2.2 Explain the various modes of component or structural failures as mentioned in (2.1). 2.3 Describe factors that promotes modes of failures e.g.. <ul style="list-style-type: none"> - Stress History 	Ask students to name various modes of structural failure. Explain them and factors that promote modes of failings of preventing them. Ask the students to describe the modes, consequences of failure due to corrosion.	<ul style="list-style-type: none"> • Ditto

	<ul style="list-style-type: none"> - Resolved Stresses - Material properties.\ - Environmental Service condition. <p>2.4 Explain methods of preventing these modes of failures.</p> <p>2.5 Explain corrosion modes.</p> <p>2.6 Describe the consequences of corrosion.</p> <p>2.7 Explain the main consequences of failure:</p> <ul style="list-style-type: none"> - Failure of equipment. - Collapse of Structures. - Explosions in pressure systems. - Release of hazardous substances. 		
General Objectives 3.0: Know the Pre-conditions for structural and component failures.			
	<p>3.1 State the various Pre-conditions for structural and component failures, such as:</p> <ul style="list-style-type: none"> - Incompetent engineers in design, production or maintenance. - Actual working condition different from design. - Shortcomings in engineering and operating procedures. <p>3.1 Explain the conditions in (3.1).</p> <p>3.2 Discuss the role of design in the prevention and detection of in-service failures.</p>	<p>Ask students to enumerate the various Pre-conditions for structural and component.</p> <p>Ask students to discuss the role of design in prevention of in-service failures.</p>	<p>Chalk Board Chalk.</p>
General Objectives 4.0: Know the Methods of Non-Destructive Testing.			
	<p>4.1 Define Non-destructive testing.</p> <p>4.2 Outline methods available for NDT of components.</p> <p>4.3 Describe the methods used for surface</p>	<p>Ask students to:</p> <ul style="list-style-type: none"> - outline NOT components - Describe methods used to detect surface flaws. - Techniques used to detect internal flaws. 	<p>Magnifying lens Ultra sonic; Instrument. Penetrate Magnetic Particle Detector.</p>

	flaws only e.g. - Visual Inspection - Penetrant and - Magnetic particle inspection. 4.4 Describe the techniques used for surface and internal flaws e.g: - Radiography - Ultrasonics. 4.5 State the merits and demerits of the methods stipulated in (4.3) and (4.4) above.	- State the merits and demerits different Techniques.	
General Objectives 5.0: Understand Techniques used in Assessing Flaws in Structure.			
	5.1 Define Fracture mechanics. 5.2 Explain the use of Fracture mechanics in the determination of the residual safe life of flawed components and structure. 5.3 Explain the roles of Total quality management and Quality Assurance technique in the promotion of reliability.	Ask students to define Fracture Machine and state its uses. Ask students to explain the role of quality assurance Technique and quality management in promoting reliability.	Charts and Cardboard papers, and Pencils.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENGINEERING TECHNOLOGY			
COURSE: Water Chemistry		Course Code: EET 321	Contact Hours 2 - 0 - 3
Course Specification: Theory and Practical			
WEEK	General Objective: 1.0 Understand chemical nature of water.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.6 Explain the chemical nature of water. 1.2 Discuss gases in water.	1. Discuss the chemical nature of water and dissolved gases in it.	Chalk and Chalkboard felt, Pen and magnetic board.
	General Objectives 2.0: Understand water quality parameters.		
	2.1 Explain water quality, demand, usage and sources. 2.2 Describe the various chemical parameters used in water Quality Control such as: a) B.O.D b) C.O.D c) D.O. d) Acidity e) Alkalinity f) P.A. g) Water hardness h) Colour I) Turbidity j) Trace metals. 2.3 Explain the water quality standards for various water uses. 2.4 Determine water quality control Parameters as in 2.2 above.	Explain water quality, demand, usage and sources. Describe the various Chemical parameters used in water quality control and demonstrates their determination of such parameters as BOD, COD, Acidity, Alkalinity, Water hardness colour etc. Explain the quality standards for various water uses.	Chalk and Chalkboard Felt-pen and Magnetic board, and Equipment.
	General Objectives 3.0: Understand the chemistry of water quality determination.		
	3.3 Discuss the occurrence of the following in water; complexions, carbonaceous compound, acidity/alkalinity, turbidity and colour. 3.2 Determine in the laboratory the quality values of above in waste water.	Discuss the occurrence of the following in water complex ions, carbonaceous compounds, acidity/alkalinity turbidity and colour.	- ditto -
	General Objectives 4.0: Understand chemistry and sanitation significance of water pollution control measures		

	<p>4.1 Explain water pollution control under the following:</p> <ul style="list-style-type: none"> - Water pollution control bodies - Water quality standards - Municipal Waste treatment facilities. - Pre-treatment. <p>4.2 Explain the occurrence of DO in aquatic Environment.</p> <p>4.3 Explain chemistry of DO measurement.</p> <p>4.4 Explain the term “Waste Water”</p> <p>4.5 List types and sources of waste water.</p> <p>4.6 Describe BOD tests.</p> <p>4.7 Describe the sanitary significance of BOD.</p> <p>4.8 Explain the effects of uncontrolled Discharge of water into surface water bodies such as lakes, rivers, etc.</p>	<p>Explain water pollution control under the followings.</p> <p>Water pollution control bodies.</p> <p>Water quality standards.</p> <p>Municipal Water treatment facilities and pre-treatment.</p> <p>Explain the term “waste water” lists types and sources of waste water.</p> <p>Explain the effect of uncontrolled discharge of waste water into surface water bodies such as rivers lakes etc.</p>	<p>- ditto –</p>
General Objectives 5.0: Understand the characteristics of oil field water.			
	<p>5.1 Explain sampling procedures for oil field water meant for different tests.</p> <p>5.2 Discuss report patterns and field analysis.</p> <p>5.3 Express reports and water patterns</p>	<p>Explain sampling procedures for oil field water meant for different tests.</p> <p>Discusses report patterns of oil field water analysis.</p>	<p>Chalk and Chalk board felt pen and magnetic board, and laboratory equipment.</p>
General Objectives 6.0: Understand the determination of elements used in predicting scales.			

	<p>6.1 Explain why scales are formed and identify common scales.</p> <p>6.2. State how to predict scale formations.</p> <p>6.3. Explain water compatibility.</p> <p>6.4. Explain scale prevention and control.</p> <p>6.5. Carry out scale analysis and propose scale Removal methods.</p> <p>6.6. Carry out water analysis calculations used in predicting scale formation.</p> <p>6.7. Calculate relative phigging index.</p>	<p>Explain why scales are formed and identify common scales. State how to predict scale formations and water compatibility. Explain scale prevention and control. Carry out scale analysis and propose scale removal methods. Carry out water analysis calculations used in predicting scale formation. Calculate relation plugging index.</p>	<p>- ditto -</p>
<p>General Objectives 7.0: Know water flood injection systems.</p>			
	<p>7.1 Explain water flood injection and system analysis.</p> <p>7.2 Explain water compatibility using water Patterns.</p>	<p>Explain water flood injection and systems analysis. Explain water compatibility using water patterns.</p>	<p>- ditto -</p>
<p>General Objectives 8.0: Understand characteristics and uses of drilling fluids.</p>			

	<p>8.1 State the main purpose of drilling fluids</p> <p>8.2 List substances used as drilling fluids.</p> <p>8.3 State the physical-chemical properties of drilling fluids.</p> <p>8.4 Explain different types/classes of drilling fluids.</p> <p>8.5 Define thixotropy.</p> <p>8.6 Identify types of rocks and describe the significance of S.G water lose, shear strength and thoxitropy of drilling fluid.</p> <p>8.7 Explain precautions for prevention of Harmful effect of drilling fluids on pipes.</p> <p>8.8 Carry out determination of mud parameters; S.G. water loss, relative viscosity; petroleum content, coarse dispersed fractions, 24 hour sediment; solid-phase composition, bentonite composition.</p> <p>8.9 Explain interaction of mud with rock (name reasons for rock destruction in drilling).</p>	<p>State the main purpose of drilling fluids.</p> <p>List substances used as drilling fluids.</p> <p>Explain different types/classes of drilling fluids.</p> <p>Define thixotropy.</p> <p>Identify type of rocks and describe the significance of specific gravity, water lose shear strength and thoxitropy of drilling fluids.</p> <p>Explain precautions for preventing harmful effect of drilling fluids on pipes.</p> <p>Demonstrate the determination of mud parameters such as S.G. water lose, relative viscosity petroleum content, coarse dispersed fraction, 24- hour sediment solid phase composition, bentorute composition.</p> <p>Explain interaction of mud with rock (name reason for rock destruction in drilling).</p>	<p>- ditto -</p>
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PROGRAMME: HND IN ENVIRONMENTAL AND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE: Water Chemistry		Course Code: EET 321	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct Practical to Improve the Theoretical Content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Determine BOD 1.2 Determine COD 1.3 Determine DO 1.4 Determine Acidity. 1.5 Determine Alkalinity. 1.6 Determine Trace metals. 1.7 Carry out scale analysis tests. 1.8 Determine specific gravity, Water loss, Viscosity, Shear strength tests of drilling fluids.	Technologist guides the students in BOD determination. ask students to determine the COD ask students to determine the D.O. ask students to determine the Acidity. ask students to determine the alkalinity. ask students to determine the trace mentals in a provided sample. ask students to carry scale analysis tests. ask students determines specific gravity water loss, shear strength of drilling fluids. All the activities are done based on the guideline of practical manual prepared by the lecturer.	Equipment; such as AAS, PH meter, incubator etc.

PROGRAMME: HND INDUSTRIAL SAFETY ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Environmental Hazards and Control		Course Code: IST 321	Contact Hours: 2-0-0
Course specification: Theory			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the basic definitions of geographic Environmental Hazards		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Define an environmental hazard 1.2 Define geographical hazard 1.3 State the environmentalist definition of environmental deterioration 1.4 Explain the concept of environmental quality 1.5 Describe climatological factors as agents of environmental hazards.	Discuss environmental hazard and climatological factors as agents of environmental hazards. Discuss the concept of environmental quality and environmental deterioration.	Chalkboard, Felt Pen and Magnetic Board, Auto visual Aids.
	General Objective 2:0: Understand the basic principles of desertification		
	2.1 Define desertification 2.2 Describe the process of desert encroachment 2.3 Identify the causal agents of desert encroachment 2.4 Explain types and patterns of desertification 2.5 Explain the effects of desert advancement on the environment 2.6 Explain the climatological hypothesis of desertification 2.7 Describe ways of preventing desertification.	Describe desertification and process of desert encroachment. Identify the causal agents of desert encroachment. Discuss types, patterns and ways of preventing desertification stress climatological hypothesis of desertification.	- Do -
	General Objective 3.0: Understand the Process of Soil Erosion		
	3.1 Describe the soil erosion process 3.2 List causes of erosion	Discuss soil erosion process, causes and effect on soil.	Chalkboard, Map Audio Visual Aids Charts etc

	<p>3.3 Explain the effect of erosion on soil</p> <p>3.4 Describe glacial scars and wave erosion</p> <p>3.5 Describe erosion patterns in different soil types</p> <p>3.6 List various erosion features</p> <p>3.7 Explain irrigation as a soil erosion hazard</p> <p>3.8 Explain ways of preventing erosion.</p>	<p>Enumerate various erosion features.</p> <p>Describe erosion pattern, soil erosion hazard and ways of preventing erosion.</p>	
General Objective 4.0: Understand the Basic Principles of Floods			
	<p>4.1 Define geophysical hazard</p> <p>4.2 List geophysical occurrences in nature that disturb the environment</p> <p>4.3 Explain the environmental hazards of floods, hurricanes, typhoons, and monsoons</p> <p>4.4 Explain the role of the following in making or breaking landscapes:</p> <ul style="list-style-type: none"> - rivers and streams - earthquakes and landslides - hurricane, typhoons, monsoons and floods <p>4.5 Describe flood as a natural phenomenon</p> <p>4.6 Identify flood-susceptible areas</p> <p>4.7 Explain ways of preventing floods.</p>	<p>Define geophysical hazard and hot geophysical occurrences – nature</p> <p>Explain flood as a natural phenomenon and as an environmental hazards</p> <p>Discuss ways of preventing floods.</p>	- Do -
General Objective 5.0: Understand basic principles of drought			
	<p>5.1 Define drought as a natural phenomenon</p> <p>5.2 Describe the drought process</p> <p>5.3 Identify the causal agents of drought</p> <p>5.4 Describe the early warning systems of drought</p> <p>5.5 Explain the climatological hypothesis of drought formation</p>	<p>Discuss drought process and as a natural phenomenon</p> <p>List the casual agents of drought</p> <p>Explain the climatological hypothesis of drought and early warning system of drought.</p>	- Do -
General Objective 6.0: Understand pest infestation of the environment			

	<p>6.1 Define Pests</p> <p>6.2 List the various classes of pests (e.g. avian, insect, micro-organisms, serpentine and animal pest)</p> <p>6.3 Explain pest infestation as consequence of pests search for food and shelter from plants and animals</p> <p>6.4 Explain pest infestation as a form of parasitism and environmental deterioration</p> <p>6.5 Describe the mode of action of insect pests</p> <p>6.6 Explain the role of micro-organisms in pest infestation of plants and animals</p> <p>6.7 Distinguished between “animal pest activity” and “animal food chain activity”.</p> <p>6.8 Describe the control measures for pest infestation.</p>	<p>Define and list the various classes of pests</p> <p>Show students the consequence of pests searching food and shelter from plants and animals</p> <p>Explain the mode of action of insect pest and micro-organism e.g. parasitism, environmental deterioration etc</p> <p>Distinguish between animal pest activity and animal food chain activity</p> <p>Give control measures for pest infestation.</p>	<p>Chalkboard, Use of Charts, Visual Aids, Diagrams.</p>
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PROGRAMME NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENGINEERING TECHNOLOGY			
COURSE: MICROBIOLOGICAL TECHNIQUES		Course Code: EET 322	Contact Hours 2 – 0 - 3
Course Specification: THEORY AND PRACTICAL			
WEEK	General Objective: 1.0 Know general laboratory procedure and materials.		
	Specific Learning Outcome	Teachers Activities	Resources
1.	1.1 State laboratory rules. 1.2 Identify equipment of the microbiology laboratory.	State essential microbiological laboratory rules for laboratory worker's safety and efficiency. List and show students' basic equipment of microbiology laboratory.	Chalkboard, Basic microbiological equipment/tools in a laboratory
2.	General Objectives 2.0: Know microscopic observation of micro-organisms		
	2.1 Identify the parts of a microscope and state the functions of the parts. 2.2 Set-up and use a microscope for microbiological examination. 2.3 Make drawings of materials observed under a microscope. 2.4 State precautions to be observed in using the microscope.	State the value of a microscope. Show students a compound light microscope and identify the parts. State the functions of the parts and demonstrate the operational steps and necessary precautions. Guide Students to operate the microscope and draw specimens.	Chalkboard. Compound light microscope, permanent slides.
	General Objectives 3.0: Know Staining Methods		
	3.1 Do the simple stain. 3.2 Do the negative stain. 3.3 Do the gram stain. 3.4 Do the acid-fast stain. 3.5 Do staining for cell structures – spore, capsule, etc.	State basic classification of microbiological stains with examples. List types of staining techniques and their application. Demonstrate and then guide students to do the staining methods listed in (3.1) to (3.5).	Chalkboard, Relevant microbiological stains, Prepared culture plates of bacteria, Microscope, plain slides, Relevant tools/materials to do staining.
	General Objectives 4.0: Know Media Preparation		
	4.1 Prepare nutrient broth, glucose broth, yeast-extract broth, and nutrient agar.	Explain the value of media in a microbiology laboratory. State basic classification of media by physical and chemical	Chalkboard, Relevant media,

	<p>4.2 Prepare a chemically-defined medium.</p> <p>4.3 Evaluate a media for ability to support growth of bacteria.</p> <p>4.4 Use selective, differential and enriched media.</p>	<p>characteristics and their applications.</p> <p>Demonstrate and then guide students to prepare media listed in (4.1) and (4.2).</p> <p>Explain how to evaluate a media for ability to support growth of a particular bacterial type.</p> <p>Guide students to use classes of media listed in 4.4 to isolate organisms from the environment.</p>	<p>Autoclave, Petriplates, Incubator, Other accessories/Materials for media preparation e.g Bunsen burner, deionized/ distilled water, etc.</p>
General Objectives 5.0: Know pure culture techniques.			
	<p>5.1 Demonstrate the streak-plate method for isolation of pure cultures.</p> <p>5.2 Demonstrate the pour –plate method for isolation of pure culture.</p> <p>5.3 Demonstrate anaerobic culture methods.</p> <p>5.4 Maintain and preserve cultures.</p>	<p>Discuss the need for pure cultures.</p> <p>Demonstrate the streak plate and pour-plate methods of isolating pure culture.</p> <p>Guide students to do isolation of pure culture in the lab.</p> <p>Explain and demonstrate anaerobic culture methods.</p> <p>Discuss ways of maintaining and preserving microbiological cultures.</p>	<p>Chalkboard, Prepared mixed Culture of bacteria in petri-plate, Sterile solidified/unsolidified agar plates, Accessories/tools needed for aseptic transfer of microorganisms/incubator.</p>
General Objectives 6.0: Understand Characterization of Unknown Culture			
	<p>6.1 Perform morphological, cultural and biochemical characterization of unknown cultures.</p> <p>6.2 Identify protozoa by microscopic examination.</p> <p>6.3 Cultivate and characterize algae.</p>	<p>State the need for and parameters used for characterization of unknown bacterial cultures.</p> <p>Demonstrate and guide students to characterize unknown bacterial culture using basic parameters.</p> <p>Guide students to cultivate and identify microscopically protozoa and alga forms.</p>	<p>Chalkboard, Basic characterization scheme chart, Pure-culture of Unknown bacteria, Relevant basic biochemical reagents and stains, Microscope and plain slides, Accessories/Materials needed to cultivate protozoa and algae.</p>

General Objectives 7.0: Know Control of Microbial population by Physical and Chemical agents.		
<p>7.1 Perform sterilization with autoclave. 7.2 Perform sterilization with hot-air oven. 7.3 Perform sterilization by filtration. 7.4 Perform sterilization with chemical agents. 7.5 Perform a comparative evaluation of antimicrobial chemical agents (disinfectants and antiseptics).</p>	<p>Explain the need for control of microbial population using examples. Demonstrate and guide students to do sterilization various. Explain how to check for effective sterilization. Guide students to perform a comparative evaluation of chemical agents for anti-microbial activity.</p>	<p>Chalkboard, Equipment needed in 7.1 to 7.3, common house-hold disinfectants, Glasswaves/other accessories, Prepare culture plate of bacteria.</p>
General Objectives 8.0: Know microbiological examination methods for various environmental components.		
<p>8.1 Perform enumeration of bacteria by the platecount technique. 8.2 Perform bacteriological examination of water. 8.3 Perform bacteriological examination of raw and pasteurized milk. 8.4 Perform microbiological examination of foods. 8.5 Perform microbiological examination of soil samples.</p>	<p>Explain reason for enumeration of bacteria in materials and state different available methods routinely used in labs. Demonstrate and guide students to enumerate bacteria by plate-count method. Explain technique of and guide students to do bacteriological examination of water, raw and pasteurized milk, foods, and soil.</p>	<p>Chalkboard Colony counter Properly collected samples of the various listed materials to be examined. Relevant media and reagents Incubator Other relevant accessories/materials for the tasks.</p>

PROGRAMME: HND IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Microbiological Techniques		Course Code: EET 322	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct Practical to Improve the Understanding of Students.		
	Specific Learning Outcome	Teachers Activities	Resources

	<p>1.1 Examine/identify equipment routinely used in a microbiology laboratory.</p> <p>1.2 Carry out microscopic examination of microorganisms (bacteria and fungi).</p> <p>1.3 Simple staining and gram-staining of bacteria.</p> <p>1.4 Prepare and pour plates of agar media (e.g nutrient agar, selective media and differential media).</p> <p>1.5 Prepare broth media in 1.4 above.</p> <p>1.6 Prepare pure cultures from a mixed culture.</p> <p>1.7 Identify an unknown bacteria culture (morphological, cultural and biochemical characterization).</p> <p>1.8 Demonstrate the control of microbial population by physical and chemical methods-filtration, dry heat, moist heat and chemical.</p> <p>1.9 Compare/evaluate chemical agents in microbial control</p> <p>1.10 Enumerate bacteria in an environment (e.g. soil and Water).</p> <p>1.11 Examine water for drinking (bacteriological examination of water).</p> <p>1.12 Examine water sample for industrial problem bacteria e.g. sulphate reducing Bacteria (SRB).</p>	<p>Technologist to prepare equipment under the supervision of the.</p> <p>Technologist to assist in methodology.</p> <p>Technologist to monitor students.</p> <p>Demonstrate the required practical.</p> <p>Lecturer to prepare laboratory manuals.</p> <p>Technologist to collect reports from students.</p> <p>Lecturer to assess the students.</p>	<p>Equipment instruments apparatus and materials/consumables required for each experiment.</p>
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PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENGINEERING TECHNOLOGY			
COURSE: Advanced Safety Management		Course Code: 1ST 322	Contact Hours 2 - 0 - 0
Course Specification: Theoretical			
WEEK	General Objective: 1.0 Understand safety organizations in the industry.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 State principles and purpose of effective safety management in an industry. 1.2 List and classify safety organization into the general types: line organization, safety director, and safety committee types. 1.3 Discuss the main features of organization in 1.2. 1.4 Explain the significance, the use of safety representatives and union participation in safety management. 1.5 Explain the types, composition and functions of safety committees.	Explain the principles and purpose of effective safety management. Discuss features of various classes of safety organization. Stress significance of union/representatives participation. Explain types, composition and functions of safety committees.	<ul style="list-style-type: none"> - Chalk - Chalkboard
	General Objectives 2.0: Know procedures in establishing an effective safety programme		

	<p>2.1 State the purpose of establishing a safety programme.</p> <p>2.2 Discuss activities in establishing a safety programme aimed at hazard elimination: planning, safety in purchasing, inspection, J.S.A., accident investigation.</p> <p>2.3 Discuss activities in establishing a safety programme aimed at developing safe behaviour: placement, training, supervision, education, employee participation.</p> <p>2.1 List ways of ensuring that the safety programme meets the set goals.</p>	<p>Explain the purpose of establishing a safety programme. Discuss activities aimed at hazard elimination and developing safe behaviour. Explain ways of meeting set goals.</p>	<ul style="list-style-type: none"> - Chalk, - Chalkboard - SSA work sheet - Checklist for Inspections.
General Objectives 3.0: Know safety educational techniques			
	<p>3.1 Define the terms “Safe Education, and “Safety Training”</p> <p>3.2 Outline the fundamental elements that must be in a successful safety training procedure.</p> <p>3.3 List situations that warrants immediate training of an employee e.g. new employee, new technology etc.</p> <p>3.4 Discuss the various specific media used in safe education and training</p>	<p>Differentiate between safe educational safety training. List elements contained in a safety training procedure and situations that warrants training of employees. Ask students to explain various media used in safe education and training.</p>	<ul style="list-style-type: none"> - Chalk - Chalkboard
General Objectives 4.0: Know methods of promoting safe practice			
	<p>4.1 Discuss the major motivating characteristics in men that can be effectively appealed to in a promotional</p>	<p>Explain the motivating characteristics in man that can be appealed to in a promotional safety programme.</p>	<ul style="list-style-type: none"> - Chalk - Chalkboard - Posters - Films shows

	safety programme: instinct of self-preservation, desire for material gain, competitive instinct etc.		
General Objectives 5.0: Know how to appraise employee attitude towards safety			
	5.1 State the significance of appraising employee attitude towards safety. 5.2 Discuss procedures for gathering and applying reports from the following in appraising employee attitude towards safety: (a) Safety personnel (safety inspectors, worker safety committeemen etc). Forman Canvass a) Sampling by personal contact b) Suggestion systems c) The safety inventory or questionnaire. 5.3 Use safety inventory tools in appraising employee attitude towards safety.	Explains the significance and procedures for appraising employee attitude. Employ safety inventory tools in appraisal of employees attitude.	- Chalk - Chalkboard
General Objectives 6.0: Know how to appraise safety performance			

	<p>6.1 Define, calculate and state the significance of the following terms in appraising safety performance.</p> <ol style="list-style-type: none"> a) Injury frequency rate b) Injury severity rate. <p>6.2 List scale of time charges as in injuries computed in accordance with existing international and national standards.</p> <p>6.3 Discuss application of the injury frequency rates for contest purposes and for injury-prevention contests.</p> <p>6.4 Discuss in-plant appraisal methods.</p> <p>6.5 Explain the use of the following parameters as basis for appraising plant safety conditions:</p> <ol style="list-style-type: none"> a) Housekeeping b) machinery safeguarding c) Maintenance d) Adequacy of equipment essential to safety. <ol style="list-style-type: none"> a) Provisions for worker comfort. b) Define programme of safety training. <p>6.6 Discuss appraisal of management attitude toward safety through assessing:</p> <ol style="list-style-type: none"> a) Knowledge of accident prevention possessed by the Chief executive. b) The amount of executive leadership he gives to the safety worker. c) The means he uses to stimulate employee safety mindedness. 	<p>Define accident statistics.</p> <p>Give problems on accident statistics to students to solve.</p> <p>Explains the significances of accident formulae.</p> <p>Explains the uses of injury frequency rates.</p> <p>Describes in-plant appraisal methods</p> <p>Use some parameter to appraise management attitude toward safety.</p>	<ul style="list-style-type: none"> - Chalk - Chalkboard - Charts
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PROGRAMME: HND INDUSTRIAL SAFETY ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: APPLIED REMOTE SENSING		Course Code: EET 324	Contact Hours: 2-0-0
Course specification: Theoretical and Practical			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the Use of Lasers in Surveying		
	Specific Learning Outcome	Teacher Activities	Resources
1	<p>1.1 Give an account of the historical background of position-fixing by satellite.</p> <p>1.2 Explain the Doppler shift of frequency and its use in position-fixing by means of satellite systems.</p> <p>1.3 Describe the global positioning system.</p> <p>1.4 Describe typical position-fixing equipment e.g. magnavox MX 2502, the wild WM101, for recording and computing satellite data and display of 3-dimensional fix results.</p> <p>1.5 Explain the position-fixing technique, with special reference to:</p> <p style="padding-left: 40px;">i. Satellite signals: stable frequencies for Doppler measurements, timing signal, predicted orbital parameters.</p> <p style="padding-left: 40px;">ii. The Doppler measurement minimum observations required for a fix.</p>	<p>Explain GPS.</p> <p>Explain the historical background of position fixing by satellite.</p> <p>Describe various equipment used</p> <p>Explain position fixing in relation to satellite signals and Doppler measurement.</p>	GPS
	General Objective 2.0: Know the Geometric Characteristics of Thermal, Radar, Landsat and Spot Imageries		
	<p>2.1 Discuss the sources of distortions present in imageries.</p> <p>2.2 Explain the causes of each type of distortion.</p>	<p>Explain distortions in imageries</p> <p>Discuss effects of start range and relief in SLAR/SPOT imageries.</p> <p>Explain spectral signature and parallax on thermal, slar,</p>	MSS, SPOT,SLAR imageries and CCT's

	<p>2.3 Discuss the effects of slant range and ground range on SLAR and SPOT imageries.</p> <p>2.4 Explain relief displace in SLAR and SPOT imageries.</p> <p>2.5 Explain the characteristics of signal returns from terrain features.</p> <p>2.6 Compute image distortion resulting from tangential distortion, cell-size variation, one-dimensional relief displacement on thermal, SLAR, landsat and SPOT Imageries.</p> <p>2.7 Determine parallaxes on thermal, SLAR, landsat and SPOT imageries.</p>	landsat and SPOT imageries.	
General Objective 3.0: Understand the Techniques of Interpretation of Thermal, Radar, L/Sat & SPOT Imageries			
	<p>3.1 State the bands and ranges of pulse transmission of SLAR and SPOT landsat and Thermal system.</p> <p>3.2 Discuss the photographic characteristics of like-polarized and cross-polarized of SLAR imageries.</p> <p>3.3 Describe the diunal radiant temperature for soil, soil, rock and water.</p> <p>3.4 Determine the differences in radiant temperatures existing within a scence.</p> <p>3.5 Explain the development of digital terrain model of thermal maps.</p> <p>3.6 State the advantages and limitations of remotely sensed imageries.</p>	<p>Explain bands and ranges of pulse transmission.</p> <p>Discuss radiant temperatures of earth features.</p> <p>State the advantages and disadvantages of remotely sensed imageries.</p>	<p>* Chalkboard</p> <p>* Graphs</p>
General Objective 4.0: Understand Planimetric, Analogue and Digital Techniques for Image Enhancement			
	4.1 Define image enhancement.	Define image enhancement	* Chalkboard

	<p>4.2 Mention the different methods of image enhancement.</p> <p>4.3 Explain the methods of density slicing colour enhancement, contrast stretching, smoothing and edge enhancement.</p> <p>4.4 Explain the necessity of coaxilling data for image enhancement.</p>	<p>Explain methods of image enhancement such as density slicing, smoothing etc.</p>	
General Objective 5.0: Know the Calibration Parameters for the Application Remotely Sensed Data in Environmental Resource Management.			
	<p>5.1 Differentiate the bands used in environmental remote sensing.</p> <p>5.2 Identify the energy bands suitable for different earth resources.</p> <p>5.3 Explain the use of composite bands in the study of earth resources.</p> <p>5.4 Identify the bands used for air, water and land pollution.</p> <p>5.5 Explain the use of thermal scanners in sensing seepages of oil on underground water.</p> <p>5.6 State the advantages and limitation of thermal, radar, landsat and SPOT imageries.</p>	<p>Explain the Electromagnetic Spectrum.</p> <p>Discuss energy bands suitable for earth features discuss the use of thermal scanners in sensing seepage and land pollution.</p> <p>State advantages and limitations of each scanner.</p>	<p>* Chalkboard</p>
General Objective 6.0: Understand the Basic Principles of Geographical Information System and its Application in Environmental Monitoring and protection.			
	<p>6.1 Define Geographical Information System (GIS).</p> <p>6.2 Define environmental monitoring.</p> <p>6.3 Discuss the basic principles of Geographical Information System.</p> <p>6.4 Discuss the application of information technology in environmental monitoring.</p> <p>6.5 Discuss the basic elements of environmental monitoring.</p> <p>6.6 Explain the use of GIS in environmental</p>	<p>Define G.I.S.</p> <p>Explain the basic principles of GIS.</p> <p>Discuss application of information technology in environmental monitoring.</p> <p>Explain use of GIS in environmental monitoring and protection.</p>	<p>-</p>

	monitoring and protection.		
General Objective 7.0: Understand the Application of Remote Sensing Equipment to Environmental Monitoring and Industrial Safety.			
	<p>7.1 Discuss the use of the following remote sensing equipment: Side looking Airbone rader (SLAR) Multispectra scanner Radiometer, Diachronic Filter Landsat Imagery, Sport Satellite, Photographic Records from space, GPS, GIS, GPR (Ground Penetratry Radar)</p> <p>7.2 Use the equipment and instrument enumerate in 7.1 above to solve environmental problems in the following areas:</p> <ol style="list-style-type: none"> i. Population dynamic ii. Water Resources management iii. Desert encouragement iv. Oil spillage v. Biodiversty monitoring vi. Air pollution monitoring vii. Industrial pollution monitoring viii. Disaster information management system. <p>7.3 Prepare contingency plan in (i) to (viii) above.</p>	<p>Discuss the use of SLAR, MSS, Radiometer, GPS, GIS, GPR etc. Solve environmental problems such as water Res. Mgt, Oil spillage, air pollution etc. Prepare contingency plan for the above.</p>	- ditto -

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENGINEERING TECHNOLOGY			
COURSE: Electrical Safety		Course Code: 1 ST 326	Contact hours 1 - 0 - 2
Course Specification: Theoretical content and practical			
WEEK	General Objective: 1.0 Understand the Principles of Electricity		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain the term “Electricity” 1.2 Itemize the principles of alternating current and direct current. 1.3 Explain the principles of supply of Electricity	Demonstrate Electricity. Explain the principles, of alternating current direct current and that of electricity supply.	Flow charts Chalk, Blackboard Audio Visuals etc.
	General Objectives 2.0: Know the statutory requirements of Electricity.		
	2.2 Discuss the electricity at work regulations 1989. 2.3 Explain the status of regulation. 2.4 Describe the voltage levels of Electricity.	Explain work regulations 1989 of Electricity. Explain Status regulation. Demonstrate the measurement of voltage levels of Electricity.	- do – Volt meter Ammeter
	General Objectives 3.0: Know the dangers from Electricity (e.g Electric Shock etc)		
	3.1 Itemize the severity of injury from electric shock. 3.2 Explain the factors that determine the amount of current that can flow through a victim’s body. 3.3 Describe the causes of injuries from low voltages. 3.4 Explain the voltage levels applicable to all electrical systems and equipment.	Explain the severity of injury sustainable from Electric shock. Explain the factors that determine amount of current flow through a victim body. Explain causes of injuries and voltage levels.	- Chalk - Chalkboard
	General Objectives: 4.0 Know the safety precautions desirable for an Electrical work		
	4.1 Describe the protective means necessary for electrical works. 4.2 Explain the competency desirable of electrical workmen. 4.3 Itemize the simple rules necessary for	Explain protective means and competency of electrical workmen and rules necessary for electrical jobs. Describe permit to work system for Electrical work . Categorize the responsibilities of Electrical inspector.	

	electrical jobs. 4.4 Explain the permit-to-work for electrical work. 4.5 Analyse what electrical Inspector should look for (equipment and hazard).		
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PROGRAMME: HND IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
Course: Biological & Chemical Instrumentation		Course Code: EET 328	Contact Hours: 1-0-2
Course specification: Theoretical and Practical			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the Principles and Instrumentation of Spectrophotometry and Colorimetry		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Explain the term spectrophotometry. 1.2 List the various sources of light for spectrophotometric determination. 1.3 State the wave-length within the electromagnetic spectrum. 1.4 Distinguish between wave-length of light within the visible region and invisible region. 1.5 Explain diffraction grating. 1.6 Explain the function of diffraction gratings in spectrophotometry. 1.7 Explain the term interference. 1.8 State the function of the optical filters spectrophotometry. 1.9 State the basic laws of spectrophotometry Bouguer-lambert's Law, 1.10 Explain the 1.11 Parts of a spectrophotometer. 1.12 Functions of the parts in the optical system of a spectrophotometer. 1.13 List the different types of detectors used in spectrophotometry. 1.14 Determine concentration of samples applying Beer-Lambert's Law and using spectrophotometer. 1.15 Carry out minor maintenance work on the spectrophotometer e.g. dusting, replacement of lamps etc.	Define the terms spectrophotometry and colorimetry. Show and state the significant of the spectrophotometer and colorimeter. State parts of spectrophotometer, colorimeter and function of each part. Explain the working principles of the spectrophotometer/colorimeter and show their basic differences and similarities. Demonstrate the steps in the use of spectrophotometer/ colorimeter. State safety/operational precautions during use. Explain basic maintenance procedures. Guides student on how to use spectrophotometer/ colorimeter .	Equipment Preparation of reagents and fixing of accessories Data interpretation Drawing.

	<p><u>Colorimetry</u></p> <p>1.16 Explain the similarities in the working principle of the colorimeter and spectrophotometer.</p> <p>1.17 Identify the various parts of a colorimeter.</p> <p>1.18 Explain the functions of the parts in 1.17 above.</p> <p>1.19 State basic similarities and differences between a colorimeter and spectrophotometer.</p> <p>1.20 Explain the limitations of colorimeters in microbiological studies.</p> <p>1.21 Carry out measurement using colorimeter.</p> <p>1.22 Carry out routine maintenance on the colorimeter e.g. care of filters and cuvettes.</p>		
<p>General Objective: 2.0: Know the Operation and Care of Flame Photometers and Raman Spectrometer</p>			
	<p>2.1 Explain the principle of operation of the flame photometer.</p> <p>2.2 Identify the various parts of a photometer.</p> <p>2.3 State the functions of the various parts of a carbon rod atomizer.</p> <p>2.4 State the similarities and differences between the spectrophotometer and the flame photometer.</p> <p>2.5 List the errors inherent impractical flame photometry and how they can be corrected particularly as applied to biology.</p> <p>2.6 Correct the errors in 2.5 above.</p> <p>2.7 Demonstrate the use of flame photometer.</p> <p>2.8 Describe and carry out typical maintenance routines for the flame photometer e.g. clearing deposits from the atomizer.</p> <p>2.9 List radiation sources and detectors.</p> <p>2.10 Identify parts of the Raman Spectrometers.</p> <p>2.11 Explain the functions of the parts in 2.10 above.</p>	<p>State the significance of flame Photometers/Raman spectrometers.</p> <p>State parts of flame Photometer/Raman Spectrometer and the function of each part.</p> <p>Discuss principle behind flame Photometer/Raman Spectrometer.</p> <p>Demonstrate the steps involved in the use of flame Photometer/Raman Spectrometer.</p> <p>List errors in use of flame Photometer/Raman Spectrometer and how to correct the errors.</p> <p>State basic maintenance of flame Photometer/Raman Spectrometer.</p> <p>Provide guides on how to use flame Photometer/Raman Spectrometer.</p>	<p>- Do -</p>

	2.12 Record spectra of known compounds using Raman Spectrometer. 2.13 Carry out routine maintenance on Roman Spectrometer.		
General Objective: 3.0: Know the Operation and Care of Atomic Absorption Spectrophotometer (AAS)			
	3.1 Draw a schematic labeled diagram of the AAS. 3.2 Identify the parts of an AAS e.g. extension source. 3.3 Describe the working principle of each of the component parts of the AAS (especially the hollow cathode lamp). 3.4 Outline the steps for operating the AAS. 3.5 Measure the absorbance of a sample of known concentration using the AAS. 3.6 Carry out routine maintenance on an AAS.	Draw a schematic diagram and identify the parts of AAS by labeling. Explain the basic principle of AAS. Demonstrate steps in the use of AAS. Carry out routine maintenance on AAS.	Reagent preparation. Accessories fixing. Data for interpretation.
General Objective: 4.0: Know the Operation and Care of the X-Ray Spectroscope			
	4.1 Identify the parts of the X-ray spectroscope. 4.2 Describe the parts listed in 4.1 above. 4.3 Draw a block diagram of an X-ray spectroscope. 4.4 Describe the operation and working principles of the units such as collimator, filters, analyzing crystals and detectors. 4.5 Measure the absorption of a given sample using the X-ray instrument and also by varying the filters. 4.6 Draw Nondispersive X-ray absorptiometer. 4.7 Carry out routine absorption measurement as in 4.5 above. 4.8 List the parts of an X-ray fluorescence spectrometer. 4.9 Identify and describe parts of an X-ray fluorescence spectrometer. 4.10 Draw a block diagram of an X-ray fluorescence spectrometer.	Describe and identify the basic parts of X-ray spectrometer. Show the operation and working principles of some units e.g. collimator, filters, detectors etc. Carry out routine maintenance care of X-ray Spectrometer e.g. cleaning of filters, verification of optical parts.	Equipment Accessories (fixing).

	<p>4.11 Analyze given samples using the X-ray fluorescence spectrometer.</p> <p>4.12 Carry out routine care of the instrument e.g. cleaning of filters, verification of optical instruments.</p>		
General Objective: 5.0: Know the Operation and Care of electrolytic conductivity bridge, coulometric titrator, pH meter, Autotitrator, polarograph			
	<p>5.1 List the component parts of:</p> <ol style="list-style-type: none"> i. electrolytic conductivity bridge ii. coulo-metric titrator iii. Auto-titrator iv. PH meter v. Polarograph <p>5.2 Identify and describe the various parts of the instruments in 5.1 above.</p> <p>5.3 Explain the principle of operation of the instruments in 5.1 above.</p> <p>5.4 Carry out various measurements using the instruments in 5.1 above.</p> <p>5.5 Carry out routine care of the instruments in 5.1 above by ensuring that</p> <ol style="list-style-type: none"> a. the cells are properly connected b. the electrodes are activated c. the instruments are switched off when not in use, etc. 	<p>List the components and identify by describing various parts of the instruments listed in 5.1.</p> <p>State the principle of operation and basic maintenance of the instrument in 5.1.</p> <p>Show how to carry out measurements using instrument in 5.1 above.</p>	<p>Equipment Accessories</p>
General Objective: 6.0: Know the Operation and Care of Radioactive Detectors and Counters			
	<p>1.1 List the various radioactive detectors and counters viz: photographic emission, ionization chambers and proportional counters, scintillation counters, semi-conductor detectors, Geiger-muller counter.</p> <p>1.2 Explain the operation of each detector and counter in 6.1 above.</p> <p>1.3 Obtain accurately the counts per sec of a radioactive</p>	<p>State various parts of radioactive detectors and counters and explain the operation of each as in 6.1 above.</p> <p>Obtain measurement for all the counters in 6.1 above.</p> <p>carryout basic maintenance for detectors and counters.</p>	<p>- Do -</p>

	<p>source (emitter) using a gas counter.</p> <p>1.4 Measure counts per sec of a beta-emitter using scintillating counter.</p> <p>1.5 Measure counts per sec for an emitter using proportional counters.</p>		
General Objective 7.0: Understand the Operation and Care of Gas Chromatographic Equipment, Flourimeter, Polarimeter and Refractometer			
	<p>7.1 Explain gas chromatography</p> <p>7.2 Identify the parts of:</p> <p style="padding-left: 40px;">(i) gas chromatography</p> <p style="padding-left: 40px;">(ii) flourimeter</p> <p style="padding-left: 40px;">(iii) polarimeter</p> <p style="padding-left: 40px;">(iv) refractometer</p> <p>7.3 Explain the working principle of each instrument in 7.1 above</p> <p>7.4 Carry out measurements using instruments in 7.1 above</p> <p>7.5 Carry out the routine care of the instruments in 7.1 above e.g. cleaning of prism with lens tissue ensuring that the polarimeter tube are clean and do not touch.</p>	<p>Discuss GC and identify the parts of instruments in 7.2 above.</p> <p>Show the working principle and measurements of using instruments in 7.2 above.</p> <p>State basic maintenance procedures</p>	<p>1. Equipment</p> <p>2. Accessories</p>
General Objective: 8.0: Know the Concepts of Hydrogen on Concentration			
	<p>8.1 Explain the term pH.</p> <p>8.2 Explain why the pH-scale ranges from 0 to 14</p> <p>8.3 State Bronsted-Bowry theory of acids and bases</p> <p>8.4 Calculate the pH of an acid and a base applying the theory in 8.3 above.</p> <p>8.5 Explain the functions of buffer with examples</p> <p>8.6 Identify a pH-meter.</p> <p>8.7 Identify and describe various parts of a pH-meter</p> <p>8.8 Explain the functions of the parts in 8.7 above. e.g. electrodes, temperature compensators, calibration knob.</p> <p>8.9 Determine the pH of a substance using a pH-meter</p> <p>8.10 Enumerate the main problems involved in pH</p>	<p>Explain pH and state the significance of pH in the Lab.</p> <p>State the parts of pH and the function of each part.</p> <p>Explain principle and demonstrate the steps in the use of pH.</p> <p>Enumerate the main shortcomings in pH measure and how to overcome them.</p> <p>Carryout routine maintenance of the pH meter.</p>	- Do -

	<p>measurement.</p> <p>8.11 Explain how the problems in 8.10 above are overcome</p> <p>8.12 Describe the potentiometric method of determination of pH</p> <p>8.13 Carry out routine maintenance of the pH-meter e.g. cleaning and reactivation of the</p>		
General Objective: 9.0: Know the Various Types of Electrodes Used in Measuring Ions like Florida, Nitrate Gas etc			
	<p>9.1 Identify ion-selective electrodes.</p> <p>9.2 State the uses of ion-exchange electrodes.</p> <p>9.3 Explain the basic principles of operation of an ion-selective electrode.</p> <p>9.4 Explain the relationship between activity and concentration of an ion</p> <p>9.5 List the various types of gas measuring electrodes</p> <p>9.6 Identify an oxygen electrode</p> <p>9.7 Identify the various parts of an oxygen electrode</p> <p>9.8 Measure accurately oxygen concentration using the gas measuring electrodes</p> <p>9.9 List and describe electrodes for pH measurement e.g. glass, combination.</p> <p>9.10 Describe and apply maintenance routines for electrodes e.g. store in distilled water, use correct concentration of reactivator</p>	<p>State and identify ion-exchange electrodes.</p> <p>Discuss basic principles of operation of an ion selective electrode.</p> <p>Compare the relationship of activity with concentration of an ion.</p> <p>Show various parts of oxygen electrode and measure oxygen concentration using gas measuring electrodes.</p> <p>Show maintenance routines for electrodes e.g. store in distilled water use correct concentration of reactivator.</p>	- Do -
General Objective: 10.0: Know the use of Microscopes			
	<p>10.1 Define microscopy.</p> <p>10.2 List various techniques of microscopy bright field, darkfield, etc.</p> <p>10.3 Explain the techniques in 10.2 above.</p> <p>10.4 Identify various types of microscopes.</p> <p>10.5 Identify the parts of the microscopes in 5.4 above</p> <p>10.6 Explain the principle of operation of scopes in 10.4</p>	<p>Define and show various techniques of microscopy.</p> <p>State parts of microscopes and function of each.</p> <p>discuss principle of operation of microscopes and demonstrate the steps in the use of microscope.</p>	Equipment Accessories (plates preparation)

	<p>above (elementary treatment only).</p> <p>10.7 View objects under the microscope.</p> <p>10.8 Carry out routine maintenance of microscope e.g. cleaning and lubrication.</p>	Show basic maintenance of microscope e.g. cleaning and lubrication.	
General Objective: 11.0: Know the use and Maintenance of Colony Counter			
	<p>11.1 Identify types of bacterial colony counters</p> <p>11.2 Identify the parts of the counter in 11.1 above</p> <p>11.3 Explain the function of each part in 11.2 above</p> <p>11.4 Describe the principle of operation of the colony counter.</p> <p>11.5 Count bacteria colonies using colony counter</p> <p>11.6 Carry out routine maintenance and repair of colony counters.</p>	<p>Identify types and parts of bacterial colony counters.</p> <p>Discuss principle of operation of bacterial colony counter and counting procedures.</p> <p>Show basic maintenance and repair of colony counter.</p>	Equipment Accessories
General Objective: 12.0: Know the use and Maintenance of Autoclave, Centrifuge and Incubator			
	<p>12.1 State the functions of (a) autoclave (b) centrifuge (c) incubator.</p> <p>12.2 Identify the parts of the instruments in 12.1 above</p> <p>12.3 Explain the functions of the parts in 12.2 above</p> <p>12.4 Sterilize, centrifuge and incubate using autoclave, centrifuge and incubator.</p> <p>12.5 Carry out routine maintenance of the instruments in 12.1 above.</p>	<p>Identify parts of the instruments in 12.1 and function of each part.</p> <p>Show basic routine maintenance of the instruments in 12.1 above.</p>	Equipment Accessories

PROGRAMME: HND IN ENVIRONMENTAL AND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE: Biological and Chemical Instrumentation.		Course Code: EET 328	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct Practical to Improve the Theoretical Content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Determine max of samples. 1.2 Determine the concentration of samples using Beers-Lambert's law. 1.3 Determine concentration of solution of samples using spectrophotometer. 1.4 Determine Na & K using flame photometer. 1.5 Determine concentrate of captions in various solutions using AAS 1.6 Determine conductivity of salt solution. 1.7 Determine end-point of titration using conductometric titration. 1.8 Calibrate and determine the PH of solutions. 1.9 Measure count per second from an emitter using any of the following:- alpha Beta and gama counters. 1.10 Separation of mixtures of organic compounds using Gas chromatograph (G.C) 1.11 Use G.C. to identify an unknown compound using suitable standards. 1.12 Determine dissolved oxygen in water samples using oxygen electrodes. 1.13 Identify the various types of microscopes. 1.14 Use the microscope to view objects. 1.15 Carry out routine maintenance of microscope (e.g. cleaning and lubrication). 1.16 Count out routine maintenance of colony counter. 1.17 Carry out routine maintenance of colony counter	Technologist to prepare equipment under the supervision of the lecturer. Technologist to assist in on methodology. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment e.g UV, AAS, Flame Photometer, GC, Microscope, Incubator, Counter etc. Apparatus e.g beaker, burette pipette, Tripod stand, bunsen burner etc.

	(e.g. cleaning)		
1.18	Sterilize materials using autoclave.		
1.19	Carry out routine maintenance of autoclave.		
1.20	Carry out mixtures using centrifuge.		
1.21	Carry out routine maintenance of autoclave (e.g Cleaning)		
1.22	Incubate cultures using incubator.		
1.23	Carry out routine maintenance of incubator (e.g cleaning).		

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENVIRONMENTAL ENGINEERING TECHNOLOGY			
Course: Solid Waste Management		Course Code: EET 411	Contact Hours 3 – 0 - 0
Course Specification: Theory			
WEEK	General Objective: 1.0 Know the General of Solid Wastes		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 State the need for solid waste management. 1.2 Describe sources and types of solid waste. 1.3 Explain the composition of solid waste. 1.4 Describe the generation rates of 1.3 above. 1.5 Classify modes of measurement of 1.4 e.g i) measure of quantity. ii) Statistical analysis of generation rate. 1.6 List factors affecting generation rate.	Explain the need for solid waste management. List and explain sources and types of solid waste. Explain the composition of solid waste. Describe the generation rates of solid waste. Classify the modes of measurement e.g.: measurement of quantity & statistical analysis of generation rate. List factors affecting generation rate.	Chalk and Chalkboard Magnetic board and felt pen.
	General Objectives 2.0: Understand the methods of on –site handling, storage and processing of solid waste.		
	2.1 Explain public health and aesthetics. 2.2 Describe the method of on-site handling for i) residential premises. ii) Commercial premises. 2.3 Describe the method of on-site storage. 2.4 Describe the methods of on-site processing e.g. grinding, compaction, shredding, composting, etc.	Explain public health and aesthetics Describe the method of on – site handling for: (i) residential premises (ii) Commercial premises. Describe the methods of on – site processing e.g. grinding, compaction composting, etc.	Chalk and Chalkboard magnetic board and felt pen.
	General Objectives 3.0: Know the methods of solid waste collection.		
	3.1 Describe collection services. 3.2 Describe collection systems, equipment and labour requirement. 3.3 List collection systems e.g. hauled container system and stationary container system. 3.4 Analyse collection systems. 3.5 Determine collection routes.	Describe collection services List and describes collection systems equipment and labour requirement. Analyse collection systems, and determine collection routes.	Chalk and chalkboard felt pen and magnetic board field trips etc.

General Objectives 4.0: Understand the methods of transfer and transportation of solid waste.			
	4.1 Explain the need for transfer operations. 4.2 Describe transfer stations. 4.3 Describe transport means and methods. 4.4 Describe location of transfer stations.	Explain the need for transfer operations. Describe transfer stations. Describe location of transfer stations. Describe transportation incomes and methods.	- ditto -
General Objectives 5.0: Understand the methods and equipment for solid waste disposal.			
	5.1 Describe solid waste disposal by sanitary landfill method. a) equipment b) supervision c) process 5.2 Describe solid waste disposal by incineration. 5.3 Describe solid waste disposal by open dumps and its potential health hazard. 5.4 Describe deep well disposal. 5.5 Describe disposal of radioactive waste.	Describes solid wastes disposal by sanitary land fill method c) factors in choice of site d) equipment e) supervision f) process. Describe solid waste disposal by incineration. Describe solid waste disposal by open dumps and its potential health hazards. Describe deep well disposal. Describe disposal of radioactive waste.	- ditto -
General Objectives 6.0: Understand the sources and utilization of various forms of energy from solid waste materials.			
	6.1 Review the principles of conservation of energy 6.2 List the forms of energy available in solid wastes. 6.3 Explain the process of energy conversions in 6.2 above. 6.4 Identify materials that can be recycled e.g. waste paper, metal scraps, X-ray materials etc. 6.5 Describe land reclamation process. 6.6 Describe the processing and recovery system. 6.7 Explain the process of incineration with heat recovery. 6.8 Define and describe pyrolysis in energy conversions. 6.9 Design a solid waste utilization process.	Review the principles of conservation of energy. List the forms of energy available in solid wastes. Explain the process of energy conversions in 6.2. Identify the materials that can be recycled e.g waste paper, metal slap X-ray materials etc. Describe land reclamation process. Describe the processing and recovery process. Explain the process of incineration with heat recovery. Define and describes pyrolysis in energy conversions. Design a solid waste utilization process.	Chalk and Chalkboard felt pen and magneticboard and equipment

PROGRAMME: HND IN INDUSTRIAL SAFETY AND ENVIRONMENTAL ENGINEERING TECHNOLOGY			
Course: Radiation Hazard and Protection		Course Code: IST 411	Contact Hours: 2 – 0 - 3
Course Specification: Theory and practical			
WEEK	General Objective 1.0: Understand Radiation fundamentals		
	Specific Learning Outcome:	Teachers Activities	Resources
	1.1 Define Radiation 1.2 Define units of radiation measure 1.3 Describe the actions, ions, isotopes as they relate to radiation. 1.4 Explain types of radiation – alpha, beta, gamma, X-rays, neutrons, radionucleotides, non-ionizing radiations. 1.5 Explain half-life (radioactive half-life biological half-life, effective half-life). 1.6 List sources of exposure to radiations e.g. x-ray machines, radioactive materials.	<ul style="list-style-type: none"> • Explain radiation and sources of radiation in the environment. • Explain changes in the orbits and the nucleus • Explain the immediate and long term effects of radiation on a body • Explain why some heavy nuclides undergo radioactive decay 	Chalk, chalkboard, weak source(s) of radiation e.g. cobalt-60.
	General Objective 2.0: Understand biological effects of radiation		
	2.1 Explain effect of ionizing radiations. 2.2 Describe somatic and genetic effects of radiation. 2.3 Explain factors that influence effect of radiation on the body. 2.4 State the maximum permissible body exposure and concentration of radionucleotides for occupational exposure.	<ul style="list-style-type: none"> - Differentiate between non-ionizing and ionizing radiation. - Explain the interaction of ionizing radiation with matter. 	Chalk, chalkboard
	General Objective 3.0: Understand the sources of radiations in industrial and commercial establishment		
	3.1 Describe the sources of radiations including x-rays in industrial and commercial establishments (including microwave ovens and radium).	*Explain sources of laboratory, industry and commercial procedures that generate ionizing radiation. *Differentiate between hard and x-rays	Chalkboard
	General Objective 4.0: Understand radiation protection		
	4.1 Explain the principles for effecting external radiation	*Explain the basic principle of radiation protection	

	protection e.g. distance, time of exposure, shielding and contamination prevention and sanitation. 4.2 State radiation protection guides for water, food and air (possible routes of radiation active substances into water, food and air).	*Explain use of shield materials for each ionizing radiation, exposure time and distance from a source.	TLD badges, Film badges Pen dosimeters etc.
General Objective 5.0: Understand the disposal of radioactive waste			
	5.1 Describe the collection and treatment of radioactive wastes 5.2 Describe the storage and disposal of radioactive wastes	Explain various sources of radioactive wastes: X-ray machine, nuclear reactors etc. Illustrate the methods of radioactive wastes collection, treatment and disposal	Chalk, Board
General Objective 6.0: Know environmental radiation surveillance and monitoring			
	6.1 State the significance of monitoring stations and sampling against radiation fallouts 6.2 Describe radiation monitoring in a radiation installation 6.3 List radiation detecting devices 6.4 Use radiation detecting devices	Explain reasons for radiation monitoring of the environment, the permissible dose, ALARA principle Describe radiation detectors and monitors	Geiger Muller counter, Radiation monitor e.g. Digilet 50 etc.
General Objective 7.0: Know radiation protection programme			
	7.1 Outline how to plan and set up a control programme in radiation protection- at local, state and federal agencies	Explain procedural guide for industrial radiography and the international atomic energy agency guidelines Explain duties and qualifications of a radiation protection officer Explain the importance of radiation safety for radiographers	Chalk, Board etc.

PROGRAMME: HIGHER NATIONAL DIPLOMAL IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Radiation Hazards & Protection		Course Code: IST 411	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct practical to improve the theoretical content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Determine Geiger Muller and proportional counter by plateau method. 1.2 Measure resolution time. 1.3 Calibrate scintillation counter using gamma ray. 1.4 Measure radiation such as alpha beta, gamma, UV, X-ray. 1.5 Calibrate radiation detection instruments. 1.6 Effect of geometry on counting efficiencies.	Technologist to prepare equipment under the supervision of the Lecturer. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment required for each practical Set of apparatus.

PROGRAMME: HND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE ADVANCED FIRE CONTROL		Course Code: IST 412	Contact Hours: 1-0-3
Course specification: THEORETICAL AND PRACTICAL			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the principles of combustion		
1	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain the fire process 1.2 State the vapour pressure and boiling point 1.3 Describe the ignition temperatures – PF, SIT, F PIT, and “Fire Point” 1.4 Explain the principles of fire spread. 1.5 State the reasons for fire spread. 1.6 Explain Explosions and Combustion products. 1.7 Explain boil over, slop over, and froth over, 1.8 Describe flammability limit	Explain fire propagation and spread, and the terms vapour pressure, boiling point, ignition temperature and fire point. Explain explosions combustion products. Boil over Slipover, froth over and flammability limits	Visual aids, chalk board and chalk
	General Objective 02: Know fire-related classification systems.		
	2.1 Explain the classification of fires 2.2 Describe the classification of flammable solids 2.3 Explain the classification of flammable liquids. 2.4 Explain the classification of flammable gasses and vapours. 2.5 Explain structural features and exits. 2.6 State the significance of fire-related classification systems.	Explain the classification of fires and the various fuels (solids, liquids, and gases)	Visual aid
	General Objective 3.0: Know fire extinguishing mechanism		
	3.1 Explain the processes of eliminating 3.2 Describe the methods of removal of heat from fire. 3.3 Explain how to extinguish air (oxygen) during fire outbreak. 3.4 Describe the inhibition of chemical reaction of combustion.	Explain fire extinguishing media and the principles of their effect on fires. Describe fire extinguishing and detection systems.	Extinguishers. Demonstrate application on live fires.

	3.5 Explain the applicability of extinguishing mechanisms.		
General Objective 4.0 : Know the extinguishing agents water and foam			
	4.1 Explain cooling capacity of water and foam 4.2 Explain the electrical conductivity of water and foam. 4.3 Describe water additives involved in fire fighting. 4.4 Explain foam concentrate, foam solution and foam expansion ratio. 4.5 Describe the general use of foam., foam concentrate types and foam quality.	Explain the cooling effect of water and foam on fire and also their electrical conductivity and therefore unsuitability for fires involving electricity. Describe water additions Explain foam concentrates, foam solution and expansion ratio, types and evaluation Make students try the application of water and foam.	Demonstrate use of foam and water with appropriate equipment. Foam and water appliances.
General Objective 5.0 Know the extinguishing agents: Halon, carbon dioxide and dry chemical powder			
	5.1 Explain the toxicity of halons. 5.2 Describe the fire extinguishing mechanisms. 5.3 Explain the general use of halon and halon quality. 5.4 State the negative effects of carbon dioxide extinguishing agent. 5.5 State the economic advantages of carbon dioxide extinguishing agent. 5.6 Describe the types and quality of dry chemical powder.	Describe the extinguishing principles of the gases and chemical powders. Explain the toxicity of halon and its withdrawal Explain the economic advantages of carbon dioxide extinguishing agent.	Demonstrate use of appliances.
General Objectives 6.0: Know fire alarms and Emergency Evacuation Procedures during fire outbreak as well as fire equipment maintenance.			
	6.1 Explain what to do when fire occurs. 6.2 State the fire emergency procedures to be adopted during a fire outbreak. 6.3 Explain how to evacuate personnel and properties from a building during fire outbreak. 6.4 Conduct a fire drill 6.5 Explain your responsibilities at fire. 6.6 Describe the Maintenance of fire fighting equipment.	Explain fire emergency and evacuation procedures fire alarms and their use. Conduct evacuation and emergency drills. Explain the need for maintaining fire appliances.	Visual aids Drills.

PROGRAMME: HIGHER NATIONAL DIPLOMAL IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Advance Fire Control		Course Code: IST 412	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct practical to improve the theoretical content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Identify and operate various types of fire detectors, explosimeter, IR detectors. 1.2 Operate various types of safety relief valves. 1.3 Operate different types of fire extinguisher and fire blankets. 1.4 Use appropriate fire extinguishing media. 1.5 Carry out a fire drills. 1.6 Carry out fire audits. 1.7 Test gas on fixed and floating roof tanks. 1.8 Connect and disconnect fire fighting hoses of/from fire hydrants and tanks. 1.9 Maintain fire extinguisher. 1.10 Determine flash points, fire points, freezing points, calorific values, API gravity.	Technologist to prepare equipment under the supervision of the lecturer. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment required for each practical Set of apparatus.

PROGRAMME: HND IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
Course: Occupational Health and Hygiene		Course Code: IST 413	Contact Hours: 1-0-3
Course Specification: Theoretical and Practical			
WEEK	General Objective 1.0: Understand the need for industrial hygiene, sanitation and occupational diseases.		
	Specific Learning Outcome:	Teachers Activities	Resources
	1.1 Define industrial hygiene and sanitation. 1.2 State the need for promoting industrial hygiene and sanitation. 1.3 Define toxicity 1.4 Explain toxicity rating of substances e.g. low, moderate, high, none, unknown. 1.5 List toxic substances and sources in an industry. 1.6 Describe effect of toxic substances: local effect, systemic effect, asphyxiation, irritation, and anesthetics. 1.7 State factors that influence effect of toxic substances e.g. dosage, exposure. 1.8 Define occupational disease; acute and chronic occupational diseases. 1.9 Describe types of occupational diseases e.g. skin diseases, respiratory, ear, eye, etc. 1.10 Classify causes of occupational diseases: mechanical agents, physical agents, chemical agents, plant poisons, biological agents. 1.11 List specific agents and the occupational disease caused.	Explain industrial hygiene and sanitation in relation to occupational disease. Explain toxicity and toxicity rating of substances Classify and explain occupational disease and their causative agents. Explain the mode of action of toxic substances	Chalk, Duster and Board
	General Objective 2.0: Understand industrial hygiene standards and compliance.		
	2.1 Define industrial hygiene standards and state the need. 2.2 State the official government agency that issue and enforce industrial hygiene standards. 2.3 Explain threshold limit value (TLV) for substances and its interpretation e.g. ceiling values (chemical and	Explain Industrial hygiene Mention governmental agency that enforces the industrial hygiene standards. Explain TLV for various substances and its interpretation.	Chalk and duster

	<p>physical agents).</p> <p>2.4 List TLV for various substances associated with occupational diseases and violation values (chemical and physical agents).</p> <p>2.5 Describe industrial hygiene compliance inspection by official compliance inspectors and procedure for determination of compliance.</p> <p>2.6 State consequences for non-compliance.</p>	<p>Explain procedure for determination of compliance.</p> <p>Explain consequences of non-compliance.</p>	
General Objective 3.0: Understand industrial environment monitoring			
	<p>3.1 Explain the meaning of industrial environmental health monitoring.</p> <p>3.2 Outline the reasons for monitoring the work environment.</p> <p>3.3 State the functions of the industrial hygiene unit in an industry.</p> <p>3.4 State the qualifications required of plant personnel responsible for environmental health tests.</p> <p>3.5 Describe use and benefit of the material and process hazard-and-effect checklist in work environmental health monitoring strategy.</p> <p>3.6 Outline the general principles of air sampling in work environment.</p> <p>3.7 Describe types of air samples: breathing zone sample, fixed position sample.</p> <p>3.8 Explain factors in air sampling procedure: number of samples, duration of samples, sample collection, sample transport, sample treatment and analysis, data and interpretation.</p> <p>3.9 List equipment to carry out air sampling for chemical substances and dust.</p> <p>3.10 List equipment to carry out sampling for physical agents</p>	<p>Explain the meaning and reasons for industrial environmental health monitoring</p> <p>Explain the functions of industrial hygiene unit in an industry.</p> <p>Explain the process and benefit of environmental health monitoring strategy.</p> <p>Explain sampling techniques for collecting industrial air samples.</p> <p>Explain the principles of equipment used for above.</p> <p>Explain plant sanitation inspection.</p>	<p>Chalk and duster</p> <p>- Laboratory equipment (for air sampling)</p>

	(light, heat, noise, vibration etc). 3.11 Describe factory facility sanitation inspection (canteens, washrooms, privies,etc).		
General Objective 4.0: Understand Industrial Hygiene and Sanitation Implementation			
	4.1 Outline the role of worker in promoting industrial hygiene and sanitation through: (i) applying personal hygiene rules (ii) good housekeeping 4.2 Outline the role of management in promoting industrial hygiene and sanitation through: (i) engineering controls that reduce health hazards in the work environment e.g. noise reduction, gaseous fume reduction, etc (ii) provision of healthy work conditions e.g. lighting, ventilation, clean water, washroom, etc. (iii) awareness programmes, training, incentives and inspections.	Explain the role of worker in promoting industrial hygiene and sanitation. Explain the role of management through: (i) engineering control (ii) provision of good working environment (iii) Awareness program, training and incentives	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Occupational Health and Hygiene		Course Code: IST 413	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct practical to improve the theoretical content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Recognise, identify and assess hazards in the work environment. 1.2 Draw up a plan to maintain health and safe working conditions. 1.3 Recognise occupational diseases associated with individual occupations. 1.4 Identify potential – physical, chemical, biological, ergonomic health hazards Associated with industrial works. 1.5 Use of equipment for air borne contaminants and other stresses (heat, noise, vibration, etc). 1.6 Use of equipment for air borne contaminants and other stresses (heat, noise, vibration etc) 1.7 Determine time-weighted average exposure of individuals to air-borne contaminants. Use toxic level meter.	Technologist to prepare equipment under the supervision of the lecturer. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment required for each practical. Set of Apparatus.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY.			
COURSE: Hazard & Operability Study		Course Code: IST 415	Contact Hours 2 - 0 - 0
Course Specification: Theoretical			
WEEK	General Objective: 1.0 Know the principles of examination of a hazard and operability study.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain what is meant by the term “hazard”. 1.2 Explain the term “Operability Study”. 1.3 Explain the basic concept of HAZOPS. 1.4 Describe the four aspects that determine the success or failure of the examination procedure of HAZOPS. 1.5 Illustrate the principles of examination procedure using a simple example of an industrial plant. 1.6 Explain the meanings of guide words in HAZOP Study.	Provide an understanding of hazard and operability study and its applications in industrial operations. Explain the principles of examination in a hazard and operability study. Explain demonstrate hazard, operability study. Explain the basic concept of Hazops. Define and explain hazard, and “operability study”. Illustrate the principles of examination procedure using a simple example of an industrial plant. Explain guide words in Hazops study.	Chalk, Board and a Plant model. Chalk Board and Plant model.
	General Objectives. 2.0: Know the procedure for a HAZOP. Study.		
	2.1 Explain the steps needed to put into practice. 2.2 Explain the objectives of the procedure for HAZOP Study. 2.3 List the two types of team member that constitute HAZOP Studies. 2.4 Explain the functions of each type of team member in HAZOPS. 2.5 List the four stages of preparative work required for HAZOP Studies. 2.6 Describe the factors that determine the amount of preparative work required for HAZOP Study. 2.7 Describe the follow-up work needed in HAZOP study.	Explain the objectives of the procedure for HAZOP study. Describe the follow-up work needed in HAZOP study. List the four preparative stages of work required in HAZOPS. List the two types of team members that constitute HAZOP studies. Explain the functions of each team member in HAZOP studies. Describe follow-up work and preparative work required in HAZOP study.	Chalk board.

	2.8 Describe the purpose of examination procedure in practice in HAZOPS. 2.9 Explain the recording of results of HAZOP study.		
General Objectives. 3.0: Know the programming of HAZOP studies.			
	3.1 Explain the need for programming in HAZOP studies. 3.2 Explain how to conduct early checking for major hazards. 3.3 Describe how to identify major hazards. 3.4 Describe when to carry out HAZOP studies at “design-freeze”. 3.5 Explain when to carry out studies pre-start up. 3.6 Explain the factors that affect studies on existing industrial plants.	Explain the need for programming HAZOP studies. Describe how to conduct early checking and identification of major Hazards. Describe how and when to carry out HAZOP studies at “design-freeze”. Explain the factors that affect studies on existing industrial plants.	Chalk and Board Old simple Plant
General Objectives. 4.0: Know the applications of HAZOP studies in industrial plants.			
	4.1 Explain the application of HAZOP study to a continuous plant. 4.2 Describe the application of HAZOP study to a batch plant. 4.3 Describe the application of the study to a proprietary item of equipment. 4.4 Describe how to start HAZOP studies. 4.5 Explain the four main kinds of training concerned with HAZOP study. 4.6 Explain the factors/Points necessary in the formalisation of HAZOP Studies.	Explain and demonstrate the application of HAZOP study to a continuous Plant. Demonstrate the application of HAZOP study to a Batch Plant. Describe the application of HAZOP study to a proprietary item of equipment. Describe how to start HAZOP study. Explain the four main kinds of Training concerned with HAZOP Study. Explain the factors and points necessary in the formalisation of HAZOP studies.	Chalk, Board, a Continuous Plant and equipment

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY AND ENGINEERING TECHNOLOGY			
COURSE: Advanced Accident Prevention		Course Code: 1ST 417	Contact Hours 2 - 0 - 0
Course Specification: Theoretical			
WEEK	General Objective: 1.0 Know the approaches to accident prevention.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain the regulation of industrial accident prevention. 1.2 Explain the statistics of industrial accident prevention. 1.3 Describe the move to severe penalties. 1.4 Explain the attitudes and justifications of Employers, employees, and government. 1.5 Explain a few recent experiments of accident prevention.	Describe the regulation of accident in industry. Explain reasons for incurring penalties Explain attitudes and justifications of employers, employees and government. Give examples of recent experiments of accident prevention .	Chalk Chalkboard Charts
	General Objectives 2.0: Know accident control through motivation and its significance		
	2.1 Explain when to motivate people in work place. 2.2 Explain what motivates people in work place. 2.3 Describe how to plan the control of accident through motivation. 2.4 Explain the significance of motivation in accident control.	Define motivation and explain when to motivate people. Explain what motivates people at work. Discuss the significance of motivation and how to plan the control accident through motivation.	Chalk, Chalkboard SSA work sheet Checklist for Inspections.
	General Objectives 3.0: Understand loss control services and prevention.		
	3.1 Explain the meaning “loss prevention” and “loss control services” 3.2 Explain the types of loss control services. 3.3 Explain the scope of loss control services in accident prevention. 3.4 Describe the specialist technical services required in loss control services. 3.5 Explain the costs of loss prevention.	Differentiate between loss prevention and loss control. Explain types, and scope of loss control services. Explain costs/benefits of loss prevention. Describe how to calculate the benefits of loss prevention and specialist technical services required.	Chalk Chalkboard

	3.6 State the benefits of loss prevention. 3.7 Explain how to calculate the benefits of loss prevention.		
General Objectives 4.0: Understand accident costing needed to support risk management programme			
	4.1 Explain the term “Accident Costing”. 4.2 Explain the three fundamental lines found to be strategies for generating and maintaining management activity in accident prevention. (4.3) Explain the costing of accidents in industry. (4.4) Describe an accident costing pilot study. (4.5) Explain the development of accident costs within a company. (4.6) Explain the use of accident costs in industry.	Explain Accident Costing. Describe how to get management involve in accident prevention. Discuss the uses of accident costing.	Chalk Chalkboard
General Objectives 5.0: Understand safety communication as a tool for accident prevention.			
	5.1 Explain the term “communication analysis” 5.2 Explain safety attitudes to communication. 5.3 Describe the guidelines for effective one-way communication. 5.4 Explain the guidelines for improved two-way communications. 5.5 Explain the barriers to effective communication in safety. 5.6 Describe the type of communication that is best in safety. 5.7 Explain the types of receivers. 5.8 Explain the assurance of message received.	Describe communication analysis. Discuss safety attitudes in communication. Explain guidelines for one and two way communications. Explain types of receives and communication best in safety. Describe types of receivers and the assurance of message received.	Chalk Chalkboard Charts.
General Objectives 6.0: Understand the cybernetic basis of the systems approach to accident prevention.			
	6.1 State the term “Cybernetic basis” 6.2 Explain the theory of operational hazards and performance safety standards. 6.3 Explain the application of operational performance	Describe “Cybernetic basis”. Explain the theory of operational hazards, performance safety standards and operational performance code.	

	<p>codes.</p> <p>6.4 Describe the principles of dynamic adaptive safety, defensive work, and predictive safety operations in hazard control.</p> <p>6.5 Explain substantiation of hazard control theory and design.</p> <p>6.6 Explain the systems meaning of operational performance safety Codes.</p> <p>6.7 State the implications of performance safety codes and standards for industry and government safety programmes.</p>	<p>Discuss the principles of :</p> <ul style="list-style-type: none"> - Dynamic adaptive safety - Defensive work - Predictive safety operations. <p>Explain substantiation of hazard control theory meaning of operational performance safety codes.</p> <p>Explain implications of performance safety codes and standards for industry and government.</p>	
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PROGRAMME: HND INDUSTRIAL SAFETY AND ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: FINAL DIPLOMA PROJECT		COURSE CODE: SEC 421	Contact Hours: 1 – 0 - 5
COURSE SPECIFICATION: PRACTICAL			
WEEK	General Objective : 1.0: Know the Collection and Collation of Data		
	1.1 Collect relevant experimental data 1.2 Collate these data for synthesis 1.3 Draw appropriate graphs and other illustrations.	Guide students on collection and collation of data	Books Journals
	General Objective : 2.0: Know Logical Presentation of Data		
	2.1 Write up project report in solid technical language. 2.2 Ensure appropriate positioning of: abstract, introduction, scope of project, previous work or literature survey, experimental results, discussions and conclusion. 2.3 Acknowledge all forms of assistance-technical, literally, moral and material. 2.4 Choose appropriate reference citation.	Explain the Proper way to write projects	Chalk Chalkboard Books
	General Objective: 3.0: Know the Project Defence		
	3.1 Submit bound project report for evaluation by supervisor(s) 3.2 Collect tangible products of the project as exhibit 3.3 Present and defend claims at viva voce.	Organise mock project defence and ask students to defend their projects	Project reports Sample of constructed work (if any)

PROGRAMME: HND INDUSTRIAL SAFETY ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: ENVIRONMENTAL ASSESSMENT		Course Code: EET 422	Contact Hours: 2-1-0
Course specification: THEORETICAL			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the Concept of Environmental Assessment		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Define the term “Environmental Assessment”. 1.2 Describe Environmental Assessment as contained in the national environmental Policy Act.	Define the term Environmental assessment. Describe Environmental assessment as contained in the National Environmental Policy act.	Chalkboard
	GENERAL OBJECTIVE: 2.0: Understand Environmental Working Documents		
	1.1 Discuss various types of environmental working documents such as Environmental Impact Assessment, Environmental Auditing. 1.2 Discuss the legal conditions and regulations on preparing E.I.A. E.A. etc. 1.3 Prepare samples of E.I.A., E.A. document formats. 1.4 Describe Environmental Contract Documents + legal and technical aspects. 1.5 Prepare samples of environmental contract documents. 1.6 Outline and explain the general processing requirements:- a. Notice of Intent b. Environmental Assessment c. Draft E.I.S. d. Finding of No. Significant impact.	Discuss types of environmental working documents, legal conditions on preparing E.I.A., E.A. Describe environmental contract documents and prepare same. Explain the general process requirements.	Legal Documents
	GENERAL OBJECTIVE 3.0: Understand Public Participation		
	1.1 Explain the following: - Effective public participation	Explain public participation public information and involvement benefits of	Charts Public meetings and visual

	<ul style="list-style-type: none"> - Public information and involvement - Participation as a group member <ul style="list-style-type: none"> - Benefits from an effective public participation programme. <p>1.2 Discuss hindrances to 3.1 above. 1.3 Organise 3.1 above. 1.4 Evaluate 3.1 above.</p>	<p>effective public participation etc. Discuss hinderance to public participation, public participation.</p>	<p>aids.</p>
GENERAL OBJECTIVE 4.0: Understand Environmental Impacts and Resource Factors			
	<p>1.1 Classify the different types of impacts, viz:</p> <ul style="list-style-type: none"> - direct impacts - indirect impacts - cumulative impacts <p>1.2 Identify the various impacts 1.3 Discuss the measure of the various impact 1.4 List examples of impacts 1.5 Explain categories of resource factors namely:</p> <ul style="list-style-type: none"> - atmosphere - water - land - biological environment - sound - human aspects - economic aspects. 	<p>Identify, various impacts and their classes. Give examples and measure various impacts Explain categories of resource factors such as water, atmosphere land human aspects etc.</p>	<p>Charts Chalkboard</p>
GENERAL OBJECTIVE 5.0: Understand Assessment Preparation and Review			
	<p>1.1 Define the scope of the environmental assessment project. 1.2 Explain the need for the following:</p> <ul style="list-style-type: none"> - Interdisciplinary team - Baseline studies - Scoping, i.e. identification of the important 	<p>Specify the scope of the environmental assessment project and assessment methodologies. Explain the need for inter-disciplinary team, scoping and baseline studies. Prepare environmental assessment (EA)</p>	<p>Charts Graphs etc</p>

	<p>issues that require full analysis.</p> <p>1.3 Describe assessment methodologies.</p> <p>1.4 Prepare an environmental assessment (EA) document from results of the impact analysis.</p> <p>1.5 Discuss document review e.g. Internal and inter agency reviews.</p> <p>1.6 Prepare a document review of an environmental Assessment Project.</p>	<p>document from results of the impact analysis and review an environmental assessment project.</p>	
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PROGRAMME: HND INDUSTRIAL SAFETY ENGINEERING TECHNOLOGY			
COURSE: ADVANCED TRANSPORTATION SAFETY		Course Code: IST 422	Contact Hours: 2-0-2
Course specification: THEORETICAL AND PRACTICAL			
WEEK	GENERAL OBJECTIVE: 1.0 Understand aircraft safety in off shore operations		
1	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain the terms “auxiliary safety”, “flight safety” and “maintenance safety”. 1.2 Explain the need to carefully label chemical mixtures going offshore 1.3 State the significance of the provision of feasible local exhaust ventilation and other engineering controls in aircraft. 1.4 State the importance of administrative controls in aircraft operation. 1.5 Describe the safety procedures for boarding Aircraft, proceeding offshore. 1.6 Explain platform disembarkation procedure from aircraft. 1.7 Describe the general aircraft instruction. 1.8 State the personal protective equipment needed for aircraft offshore employees. 1.9 State the reasons for maintaining and analyzing safety records in aircraft.	Explain the terms “Auxiliary safety” “Flight safety” and maintenance safety” Explain the significance of the provision of local exhaust ventilation and other engineering controls, as well as the importance of administrative controls and the need to carefully label chemical mixtures going offshore. Explain safety procedures for boarding aircrafts going offshore and disembarkation on plat forms, including general aircraft instructions and protective equipment required. State the reason for maintaining and analyzing aircraft safety records.	Samples of protective equipment. Chalk, chalkboard magnetic boards, over head projector and transparencies.
	General Objective 2.0: Know Road Safety in Nigeria		
	2.1 Describe the general accident trends in Nigeria. 2.2 Explain the human factors in road accidents 2.3 State the several differences between highway and urban driving. 2.4 Explain the main factors of road traffic accidents	Explain the road accident trend and human and other factors responsible for road accidents. State the difference between highway and water driving.	Samples of protective equipment. Chalk, chalkboard, magnetic board overhead/projector and transparencies.

	<p>2.5 Explain the hazards associated with unmentioned roads.</p> <p>2.6 State the conditions of the vehicles and road that can lead to accident.</p> <p>2.7 Describe the safety measures to be taken in road transportation system.</p>	<p>Describe safety measures adopted for road transport</p> <p>Make students contribute.</p>	
General Objective 3.0: Know Marine/Water Safety			
	<p>3.1. List the lifesaving apparatus (LSA) required for marine/water borne operations.</p> <p>3.2 List the types of inland waterway vessels.</p> <p>3.3 Explain the living and working conditions of Quarter Master/Room Master (boat man).</p> <p>3.4 Explain the hazards crew members are exposed to in Marine operations.</p> <p>3.5 Describe the preventive measures of these hazards associated with marine operation.</p> <p>3.6 Explain the marine legislation for Marine/Water borne operations.</p>	<p>List the types of inland waterway vessels and the types of life saving apparatus required.</p> <p>Explain the living and working conditions of the crew and the hazards to which they are exposed, and preventive measures</p> <p>Explain the relevant legislation.</p>	<p>Samples of protective equipment. Chalk, chalkboard, magnetic board overhead/projector and transparencies.</p>
General Objective 4.0: Know Railway Transportation Safety			
	<p>4.1 Explain the Safety briefing desirable for the passengers.</p> <p>4.2 Describe the duties of railway men.</p> <p>4.3 Explain the hazards associated with railway transportation system.</p> <p>4.4 Describe the safety measures to be taken to avert the possible hazards.</p> <p>4.5 Explain the effects of modernization of railway system in Nigeria.</p> <p>4.6 State the advantages of railway transportation system over the other transportation system.</p>	<p>Describe the railway system and the duties of railway men</p> <p>Explain the hazards, associated with railway transportation system and the briefing desirable for the passengers.</p> <p>State the advantages of railway transportation over other transportation over other transportation system, and the effect of modernization of the railway system in Nigeria.</p>	<p>Chalk and Board</p>
General Objective 5.0: Know defensive driving required in transportation system			
	<p>5.1 State the term “Defensive Driving”.</p> <p>5.2 Explain the driving errors committed by drivers on our</p>	<p>Explain the term “Defensive driving and the elements of defensive driving, including the</p>	<p>Visual aid/film chalk and board</p>

	<p>roads.</p> <p>5.3 Describe drive and survive rules</p> <p>5.4 State the elements of Defensive driving.</p> <p>5.5 Explain the terms “Stopping distance”, “Reaction distance”, “Following distance” and “braking distance”</p> <p>5.6 Explain the term “Second rule of following distance.</p> <p>5.7 Describe the four E’s of Safety for road traffic accident reduction.</p> <p>5.8 Explain the goals of the four E’s of Safety.</p> <p>5.9 Explain the four R’s when avoiding head-on collision.</p>	<p>drive and survive rules.</p> <p>Explain driving errors often committed by drivers.</p> <p>Explain the terms “stopping distance; ‘Reaction distance, Following distance’ and braking distance; ‘ second rule” “4E,” “4 R”</p>	
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PROGRAMME: HIGHER NATIONAL DIPLOMAL IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Advanced Transportation Safety		Course Code: IST 422	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct practical to improve the theoretical content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Draw up journey management. 1.2 Conduct safety procedures for boarding and disembarking air craft, ship/boat. 1.3 Design warning signs. 1.4 Conduct warning signals for crane operation, air craft landing etc. 1.5 Determine noise levels. 1.6 Conduct Porto clinic and glare (PCG) tests.	Technologist to prepare equipment under the supervision of the lecturer. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment required for each practical Set of apparatus.

PROGRAMME: HND INDUSTRIAL SAFETY ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: OILFIELD WATER SYSTEMS		Course Code: EET 424	Contact Hours: 2-0-2
Course specification: THORETICAL CONTENT AND PRACTICAL CONTENT			
WEEK	GENERAL OBJECTIVE: 1.0 Understand the Chemistry of Water		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Explain both physical and chemical properties of water. 1.2 State sampling procedures for oil field water meant for different tests. 1.3 Explain what is meant by Quantitative Analysis and outline different techniques for various waters. 1.4 Discuss report patterns and Field Analysis. 1.5 Express reports and water patterns.	Ask students to: -sample waters for 'oil in water test' and for routine test -draw water patterns for different water samples -fill report forms -assess the students	Glass water samples, plastic water samplers and containers Report forms Chalk, chalk board Lecture notes
GENERAL OBJECTIVE: 2.0: Understand the Concept of Water formed Scales			
	2.1 Explain why scales from the identify common scales. 2.2 State how to predict scale formations. 2.3 Explain water compatibility. 2.4 Explain scale prevention and control. 2.5 Carry out scale analysis and propose scale removal methods. 2.6 Make use of water analysis data. 2.7 Carry out water analysis calculations like: - Calcium carbonate scale calculation - Calcium sulphate scale calculation - Barium sulphate scale calculation - Strontium sulphate scale calculation - Calculation of average pH. 1.1 Draw water patterns and explain water compatibility calculations.	Ask the students to: -calculate CaCO_3 , CaSO_4 , BaSO_4 , SrSO_4 scales formed using skills and Davis extension of Langelar equation	Charts, graph papers, tables of ionic constants, ionic strength of water at different temperature

	1.2 Calculate relative Piggings Index.		
GENERAL OBJECTIVE: 3.0: Know the Causes of Corrosion in Water injection and disposal systems			
	3.1 Explain the theory of corrosion in water injection systems 3.2 Explain the effects of metal composition, water composition and physical variables on corrosion 3.3 Explain various forms of corrosion 3.4 Explain different corrosion control methods like: -coatings and linings -cathodic protection -non metallic tubular goods -removal of corrosion gases -oxygen exclusion 3.5 Explain corrosion monitoring techniques	- Ask the students to state the causes/theory of corrosion in oil field water system. - The effect of metal composition, water composition and physical variables like Temperature, O ₂ concentration etc on corrosion. - Ask the students to explain forms of corrosion and different corrosion control methods. - Ask the students to discuss corrosion monitoring techniques.	Drawing to show corrosion cell and movement of Electrons. - Electrochemical series Chalk Board, Chalk.
General Objective: 4.0: Understand the concept of oil field water treatment microbiology.			
	4.1 Identify problem – causing micro-organisms in the application of oil field waters. 4.2 Describe the techniques of culturing and enumerating bacteria in oil field waters. 4.3 State the chemicals for the control of micro-organism and the factors that determine their choice. 4.4 Explain water quality for injection purposes.	Ask students to: - Identify S.R.B in a sample with microscope. - Iron Bacteria - Name Chemicals for control of micro-organism/concentration. - Factors that determine water quality for injection purposes.	Slides, water samples, culture medium, petri-dishes.
General Objective 5.0: Know water flood injection systems.			
	5.1 Explain the water source selection and the types of treatment systems. 5.2 Describe water treating equipment 5.3 Explain water flood inspection and system analysis.	Teacher explains to students – water source selection. - Types of treatment systems/equipments - Meaning of water flooding.	Calcium Hypo chlorite, Water Fitters. Fitter Membrane
General Objective: 6.0: Know Oil Field Water Disposal Systems			

	<p>6.1 State the problems associated with pollution. 6.2 Explain the subsurface disposal methods. 6.3 Carry out essential analysis/treatments of formation and effluent water before discharge.</p>	<p>Ask students to: - explain disposal methods and pollution associated with it -carry out water analysis and identify treatments needed before discharge</p>	<p>Chalk, Chalkboard, Water analysis chemicals</p>
General Objective: 7.0: Understand Characteristics and Uses of Drilling Fluid			
	<p>7.1 State the main purpose of drilling fluids. 7.2 List substances used as drilling fluids. 7.3 State the physical – chemical properties of drilling fluids. 7.4 Explain different types/classes of drilling fluids. 7.5 Define thixotropy 7.6 Identify types of rocks and describe the significance of S.G., water loss, shear strength and thixotropy of drilling fluids. 7.7 Explain precautions for prevention of harmful effect of drilling fluids on pipes. 7.8 Carry out determination of mud parameters: S.G. water loss, relative viscosity, petroleum content, coarse dispersed fractions, 24-hour sediment, solid-phase composition, bentonite composition. 7.9 Explain interaction of mud with rock (name reasons for rock destruction in drilling). 7.10 Explain adsorbed water molecules on surface of clay particles. 7.11 Describe the relationship between electro kinetic potential, mud viscosity and water loss. 7.12 Explain relationship between adsorption capacity of clay and its viscosity.</p>	<p>Teacher to ask students to - explain uses of drilling fluids/substances used as drilling fluids. - define thixotropy S.G water loss, viscosity and uses of drilling muds. - state interaction of mud with rock. - explain relationship between Adsorption capacity and its viscosity.</p>	<p>Bentonite, C.M.C, Mohr's Balance, Fund.</p>

PROGRAMME: Higher National Diploma in Industrial Safety and Engineering Tech			
COURSE: Safety and Risk Management		Course Code: IST 424	Contact Hours 2 - 0 - 0
Course Specification: Theoretical			
WEEK	General Objective: 1.0: know the development and scope of risk management		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Define the terms: Risk, Risk management, and loss control 1.2 Explain the necessity of risk management. 1.3 State the types of risks covered. 1.4 Discuss types of losses: property, personnel etc. 1.5 Discuss ways of handling pure risks. 1.6 Explain disaster control as an element of risk management.	Differentiates between Risk, Risk management and loss control Explain why risk management is important Describe types of risks Explain risk control strategies Describe disaster control	Chalk and Chalkboard
	General Objective 2.0: Understand identification of risks		
	2.1 State methods of identifying risks. 2.2 Discuss inspection as a tool in identification of risks. 2.3 Explain the use of various data on non-injury accidents in risk identification. 2.4 Explain the application of incident recall method in risk management.	Explain various methods of risk identification	Chalk and chalkboard
	General Objective 3.0: know how to set up performance standards based on risk assessment..		
	3.1 Explain how to define the criteria and the level of detail required in setting and using safety cases and safety critical systems to develop safety standards 3.2 Explain how to clarify the link between safety cases and safety critical systems to develop safety standards. 3.3 Discuss the application of quantitative risk analysis (QRA) to improve present and future safety performance. 3.4 Discuss the re-assessment of safety goals and strategies for continuous improvement.	Explains how to set-up performance standards Describe a safety case Explains applications of quantitative risk Assessment Explains reasons for re-assessment of safety goals and strategies	Chalk and chalkboard

General Objective 4.0: Understand how to minimise the risk and determine the safety of various abandonment options within legislative requirement.			
	<p>4.1 Discuss methods in assessing the risk and safety of various abandonment options.</p> <p>4.2 Clarify the most recent safety requirements for abandonment.</p> <p>4.3 Prepare a safety case to meet with HSE approval.</p> <p>4.4 Determine the associated risk of an abandonment option to personnel, environment and third parties.</p>	<p>Describe methods for assessing risk/safety of abandonment options.</p> <p>Explains recent safety requirements for abandonment</p> <p>Describes how to prepare a safety case</p> <p>Explains risk of an abandonment option to peoples environment</p>	<p>Chalkboard, feltpen and magnetic board</p> <p>Audio visual aids</p>
General Objective 5.0: Understand allocating of responsibility for safety between operators and contractors			
	<p>5.1 Define the areas of responsibility and liability for both the operator and contractor.</p> <p>5.2 Explain the significance of verifying that both parties abide by the same safety standards.</p> <p>5.3 Discuss management of safety for short term contracts.</p> <p>5.4 Explain he determination of liabilities for mismanagement.</p> <p>5.5 Discuss risk control procedures to be used on contract</p>	<p>Explains what a contract is.</p> <p>Describes responsibility and liability for operators and contractors</p> <p>Explains significance of parties abiding to same safety standards</p> <p>Explains management of safety for short term contract.</p> <p>Describe how to determine liabilities for mismanagement</p> <p>Explain risk control procedures for contract</p>	

PROGRAMME: HND INDUSTRIAL SAFETY AND ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: ENVIRONMENTAL PROTECTION ADMIN		Course Code: EET 426	Contact Hours: 2-0-0
Course specification: Theoretical			
WEEK	GENERAL OBJECTIVE: 1.0 Understand environmental control programme planning		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 List organizations involved in environmental monitoring and protection of local and international levels. 1.2 State manpower need in environmental protection administration and roles e.g environmental engineer, sanitary health inspectors, etc. 1.3 Outline statement of goals and objectives relating to environmental protection administration. 1.4 Explain formulating a program plan in relation to 1.3 above. 1.5 Explain the need for data collection, studies and data analysis in 1.4 above.	State goals and objectives of environmental protection administration and manpower need List organizations involved in environmental monitoring and protection at different levels Explain the need for data collection and analysis	Questionnaires - Chalkboard
	General Objectives: 2.0 Understand environmental programme supervision		
	2.1 Explain the role of the following in environmental programme: supervision, evaluation, reporting, record-keeping and data processing, statistical report. 2.2 Explain types of inspections (initial, routine inspections, re-inspection, and frequency of inspection). 2.3 Describe inspection procedure. 2.4 State the overall benefit of regular environmental monitoring and inspection.	Explain the consecutive <ul style="list-style-type: none"> o stages of environmental o protection o programme. Specify types of inspections and inspection procedure. State overall benefit of environmental monitoring and inspection	- Chalkboard and Illustrations
	General Objectives: 3.0 Understand environmental programme enforcement		
	3.1 Explain comparison of performance and specification standards as tools in environmental control	Explain the role of comparing performance and specification standards in environmental	-Ditto-

	<p>enforcement.</p> <p>3.2 Explain the role of correspondence, compliance guides, education, motivation and legal action in 3.1 above.</p> <p>3.3 State non-compliance regulations</p>	<p>control enforcement.</p> <p>Specify role of correspondence, compliance guides, education etc as well as non-compliance regulations.</p>	
General Objective 4.0: Understand environmental impact statements			
	<p>4.1. Define the term “Environmental Impact Statement”.</p> <p>4.2. Explain the need for environmental impact statements by establishments before embarking on projects.</p> <p>4.3. Write an environmental impact statement to a hypothetical project.</p>	<p>Define Environmental impact statement</p> <p>Explain the need for Environmental Impact Statement by establishment.</p> <p>Write Environmental Impact Statement to a hypothetical project.</p>	
General Objective 5.0: Know Environmental Law			
	<p>5.1.State provisions in various existing statutory regulations aimed at protecting the environment.</p> <p>5.2. State international Statutory Provision on environmental protection.</p> <p>5.3 State National Statutory Provision on environmental protection.</p> <p>5.4 State local statutory provision on environmental protection.</p> <p>5.5 Apply the various laws and regulations to hypothetical cases.</p>	<p>State all existing statutory regulations regarding environmental protection locally, nationally and internationally.</p> <p>Apply the various laws to hypothetical cases.</p>	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Machinery & Tools Safety		Course Code: 1ST 426	Contact Hours 2-0-0
Course Specification: Theoretical content + Visit to Industries			
WEEK	General Objective: 1.0 Understand the Principles of Guarding.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Explain the meaning of the term “guarding” the major areas of safety as considered with machines. 1.2 Discuss guarding during maintenance of machines and written policy for ZMS (Zero Mechanical State) 1.3 Discuss guarding of hazards. 1.4 Discuss point-of-operation protective devices. 1.5 Explain the guarding of Power transmissions in machinery.	List and show different types of guards in machines in relevant workshops and industries Explain use of Charts.	<ul style="list-style-type: none"> • Equipped workshop • Machines • Charts
	General Objectives 2.0: Know safety in metal working machinery.		
	2.1 List various types of metalworking machinery. 2.2 Outline the general safety rules in operating metalworking machinery. 2.3 Discuss the functional components, the associated hazards and the safety precautions to be observed in the following metalworking machinery: (a) Turning machines (b) Boring machines (c) Milling machines (d) Planing machines (e) Grinding machines	List and show different types of metalworking machines and associated hazards. Demonstrate with relevant machines. Visit workshop/industry.	Charts, Machines, workshops
	General Objectives 3.0: Know Safety in Woodworking Machinery.		

	<p>3.1 Discuss the general Safety Principles in woodworking machinery as it concerns: (a) Electrical components; (b) Guards; (c) Work areas; (d) Material handling; (e) Inspection; (f) Health of Personnel; (g) Personal protective equipment and (h) Standards and Codes.</p> <p>3.2 Discuss the Safety Precaution in the application of the following types of Saws: (i) Circular, (ii) Over-head swing and straight-line pull cutoff saws, (iii) Under-slung cutoff saws, (iv) Radial Saws, (v) Power-feed ripaws, (vi) Band saws & (vii) Routers.</p> <p>3.3 Outline Safety Precautions in the applications of the various woodworking equipment e.g.: (i) Jointer/Planers, (ii) Shapers, (iii) Power-feed (thickness) Planers, (iv) Sanders, (v) Lathes & (vi) Routers.</p>	<p>List and show woodworking machines and their respective components. Show relevant personal protective equipment List safety and health hazards associated work activities. Demonstrate safety precaution and safe handling of special tools and equipment. Visit workshops or industry.</p>	<p>Woodworking machines Personal protective equipment, tools and components. Charts Workshops.</p>
General Objectives 4.0: Know safety In Use of Hand and Portable Power Tools.			
	<p>4.1 Discuss safe practices, centralized tool control and correct ways of carrying tools as they concern the prevention of accidents in the application of hand and portable power tools.</p> <p>4.2 Explain techniques of inspection and control of hand and portable power tools and its significance.</p> <p>4.3 State the hazards associated with and the safety precautions needed in the application of the following hand tools:</p> <p>4.4 State the hazards associated with and the safety precautions needed in the application of the following portable power Tools: (a) Electric tools (b) Air-powered tools etc.</p> <p>4.5 State type of eye protection equipment and other</p>	<p>List and show all relevant tools and equipment and associated hazards. Demonstrate safe handling and use of appropriate tools storage and maintenance. Display charts showing tools and personal protective equipment Visit workshops and industries</p>	<p>Relevant tools/equipment Charts Workshop</p>

	Personal Protective equipment required when using hand and portable power tools.		
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PROGRAMME: HND INDUSTRIAL SAFETY ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Safety in Metal Works		Course Code: IST 428	Contact Hours: 2-0-3
Course specification: THEORY AND PRACTICAL			
WEEK	General Objective: 1.0 Understand the cold forming of metals and safety precautions needed		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Describe the Power Process of Cold forming of metals 1.2 Explain the responsibility for guarding and safeguarding in cold forming of metals. 1.3 Explain the term “Auxiliary Mechanisms”. 1.4 Explain the feeding and ejecting Mechanisms in auxiliary mechanisms. 1.5 Explain the types of injuries associated with cold forming of metals 1.6 Describe the Power Pres setup and Die removal of Cold forming of metals. 1.7 Explain the inspections required in Cold forming of metals. 1.8 Explain the maintenance procedures essential in cold forming of metals.	1. Explain the value of power processes in the cold forming of metals. 2. Show and identify the basic parts of a power press and explain the term ‘auxiliary mechanisms’. 3. Discuss the feeding and ejecting mechanisms. 4. Show students a power press in operation pointing out all associated hazards. 5. List injuries associated with cold forming of metals. 6. Discuss power press setup and die removal in cold forming of metals. 7. discuss inspection and maintenance and their relevance in cold forming of metals.	Chalkboard, Charts, visit to metal works workshop.
WEEK	General Objective: 2.0 Know safety in hot working of metals		
	Specific Learning Outcome	Teachers Activities	Resources
	2.1 Outline the basic medical programmes that should Describe the essential operations that are involved in hot working of metals using a foundry. 2.2 State the types of materials that present a health hazard in foundry operations and explain their mode of production. 2.3 be put in place for the health protection of foundry workers.	List and explain the basic operations involved in hot working of metals using a foundry. Identify sources of health hazards and their sources during foundry operations. Discuss the basic medical programmes for the health protection of foundry workers. List personnel hygienic facilities relevant for health protection of foundry workers.	Chalkboard, Charts, visit to foundry workshop.

	<p>2.4 List personnel hygiene facilities that should be put in place for the health protection of foundry workers.</p> <p>2.5 Discuss the following as it relates to the safety of workers in a foundry work environment:</p> <ol style="list-style-type: none"> a. Housekeeping b. Ventilation c. Illumination d. Inspection and maintenance procedures e. Plant structures f. Using compressed air hose g. Fire protection. <p>2.6 Discuss the hazards associated with material handling in foundries and the safety precautions e.g. sand, coal and coke, ladles, skg, disposal etc.</p> <p>2.7 Describe the use of cupolas and necessary safety precautions.</p> <p>2.8 Describe the use of crucible and necessary safety precautions.</p> <p>2.9 Describe the use of ovens and necessary safety precautions.</p> <p>2.10 Discuss the use, associated hazards and safety precautions in the use of the following foundry production equipment: Sand mills, Dough-type mixers, sand cutters, sifters, molds and cores, molding machines, core- blowing machines, flasks, sandblast rooms, tumbling barrels and shake-cuts.</p> <p>2.11 Discuss the use and hazards associated with forging up setters and forging presses.</p> <p>2.12 Outline basic safety precautions in the use of forging up setters and forging presses.</p>	<p>Explain how the factors listed in (2.5) concerns the safety of workers in a foundry work environment.</p> <p>Identify hazards associated with handling materials used in foundry operations and the necessary safety precaution for each item.</p> <p>Explain the use of and necessary safety precautions for cupolas, crucible and ovens.</p> <p>State the use of, associated hazards and necessary safety precautions for the foundry production equipment listed in (2.10).</p> <p>Explain the use of forging up setters and forging presses.</p> <p>Identify hazards associated with and basic safety precautions in the use of up setters and forging presses.</p>	
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PROGRAMME: HIGHER NATIONAL DIPLOMAL IN INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING TECHNOLOGY			
COURSE: Safety In Metal Works		Course Code: IST 428	Contact Hours 0 - 0 - 3
Course Specification: Practical Content			
WEEK	General Objective: 1.0 Conduct practical to improve the theoretical content.		
	Specific Learning Outcome	Teachers Activities	Resources
	1.1 Identify hazards in cold forming mechanism. 1.2 Draw a plan for preventive measures. 1.3 Carry out inspection during metal work activities. 1.4. Carry out routine inspection in metal work. 1.5 Use various types of personal protective equipment PPE. 1.6 Identify and assess health hazards. 1.7 Identify measures for control of health hazards. 1.8 Demonstrate how to handle various hazardous materials.	Technologist to prepare equipment under the supervision of the lecturer. Technologist to monitor students. Demonstrate the required practicals. Technologist to collect reports from students. Lecturer to assess the students.	Equipment required for each practical. Set of Apparatus.

LIST OF MINIMUM EQUIPMENT

(1) ENVIRONMENTAL ENGINEERING/WATER & WASTE WATER LABORATORY

HIGHER NATIONAL DIPLOMA

1.	Water level indicator with accessories	-	2no.
2.	Well level detector	-	2no.
3.	Core sampler for marine, aquatic soil sampling Plus the following accessories:-		
	- Removal tool		
	- Nose pieces.		
	- Liner tubes		
	- Egg shell cone catcher	-	5no.
4.	Coretaker for sludge samples, Measuring sludge blanket thickness.		
5.	Imhoff settling cone for determining settle-able Materials in water and waste water samples + Support rack.	-	5no.
6.	Sludge indicator with Infrared sensor for measuring Sludge interface and concentration gradients.	-	2no.
7.	Centrifuge for determining the concentration of Suspended solids in wastewater, with 15 min Timer and auto shut-off, 220 VAC plus Transformer 230 VAC, 250 watts.	-	1no.
8.	Settler to measure rate and amount of Solid/liquid separation of sludge samples, Calibrated in percent solid and settled sludge volume.	-	5no.
9.	Flocculation test apparatus	-	1no.
10.	Bottles with stoppers	-	15no.
11.	Weight bottles with stoppers	-	15no.

12.	Remote sensing equipment consisting of Radar, Computer, etc.	-	1 unit
13.	Dust detector	-	
14.	Environmental monitoring station - for pollution monitoring		
15.	Remote sensing equipment such as Radar, SLAR, GIS, CPS, etc.		

HYDROLOGY LABORATORY

1.	Evaporation guage	-	1no.
2.	Hydrology apparatus	-	1no.
3.	Analogue weather station with separate dials for Wind speed and wind direction, measures barometric Pressure and maximum/minimum outdoor temperature	-	1no.
4.	Hydrometer	-	1no.
5.	Rain guage	-	1no.
6.	Flow channel	-	1no.
7.	Centrifugal pump rig	-	1no.
8.	Permeability tank	-	1no.
9.	Model Sedimentation tank	-	1no.
10.	Vortex Apparatus	-	1no.
11.	Venturimeter	-	1no.

WORKSHOPS

(1) SAFETY WORKSHOP (ND/HND)

1.	Eye protection spectacles:		
	- general purpose	-	20 each
	- grade 2 impact		
2.	Eye protection goggles:		

- grade 2 impact - 20 each
- grade 1 impact
- chemical, type C
- dust, type D
- gas, type G
- molten metal, type M
- 3. Face shields:
 - grade 2 impact, C resistance - 20 each
 - grade 2 impact, C and M resistance
 - grade 1 impact, C and M resistance
 - Ultraviolet
- 4. Eye wash assembly - 5
- 5. Fire extinguishers
 - BCF dry powder - 10 each
 - BCF
- 6. First aid kit (up to 30 persons) - 5
- 7. Resuscitator (Brook airway) - 5
- 8. Lifting manikin model - 1
(showing the effect of a bad lifting posture on the spine)
- 9. Safety hand gloves:
 - sterile types
 - non-sterile types
 - Heat/cold resistance types
- 10. Hazard warning labels:
 - Chemical (corrosive, flammable, irritant, toxic) - 10
 - general (laser beam, radiation, radioactive, toxic)
- 11. Protective coats:
 - flame retardant - 30 each
 - chemical resistant - 30 each
- 12. Dust/mist/fumes masks - 20 each
- 13. Respirators:

	- dust/mist type	-	5 packs
	- mercury vapour type	-	10 “
	- nuisance odour	-	10 “
	- organic vapour	-	10 “
	- acid gas	-	10 “
14.	Safety caps (Hard hats)	-	35
15.	Leather aprons	-	35
16.	Fire buckets	-	10

(2) SURVEYING EQUIPMENT STORE

1.	Abney level	-	5no.
2.	Prismatic compass with tripods		
3.	Clinometer	-	2no.
4.	Digital leveling instruments with accessories	-	5no.
5.	Three Second Total Station	-	1no.
6.	GPS system 200 SSR 299 plus accessories	-	1no.
7.	Pantograph (Small and big sets)	-	3 each
10.	Telescopic Alidades (sighting rule)	-	5no.
11.	Ranging poles	-	5no.
12.	Pentium based computers with accessories	-	10no.
13.	Digital Theodolites	-	10no.
14.	Assorted relevant software	-	1no.
15.	Surveying Umbrella	-	5no.
16.	Staves	-	5no.
17.	Steel arrows	-	5no.
18.	Planimeters	-	5no.
19.	Pocket altimeter	-	5no.
20.	Tapes (30m, 50m, 100m)	-	5 each
21.	Optical square	-	5no.

(3) DUPLICATING AND PRINTING ROOM

1.	Photostating machine	-	1no.
2.	Plan printing machine	-	1no.
3.	Duplicating machine	-	1no.
4.	Trimming machine	-	1no.
5.	Scanning machine	-	1no.

(4) OTHER FACILITIES

i)	Mechanical Workshop	-	See Mechanical Engineering Department Workshop.
ii)	Wood Workshop	-	See Civil Engineering
iii)	Computer Studio	-	12 PC, Printer, Software packages etc.
iv)	Drawing Studio		

(2) SOIL MECHANICS LABORATORY

1.	Los Angeles Abrasion machine	-	1no.
2.	Direct shear apparatus	-	1no.
3.	Triakiel test Apparatus	-	1no.
4.	Compression test apparatus	-	1no.

LIST OF EQUIPMENT FOR SAFETY COURSE

1. Proportional Counter
2. Geiger Miiler Counter
3. Radiation or Radio active Sources
4. Film bandages
5. Explosive metres
6. Smoke detector
7. Flame detectors

8. Fire Alarm System
9. Noise Level detection
10. Toxic Level detector
11. Dreager Tubes (Air samplers)
12. Relief/Safety valves
13. Slings, Ropes, Chains, Ladder,
14. Kata thermometer
15. Anemometer
16. Sling Psychrometer
17. Safety boots
18. Ear plugs, Ear Muff
19. Respirator,
20. Overall, Safety goggles (various types)
21. Manikin (First aid)
22. Stretchers
23. Bandages and other dressing
24. First Aid box
25. Audio-Films
26. Audio Visual set plus safe films.

LIST OF PARTICIPANTS @ CURRICULUM REVIEW EXERCISE

<u>NAME</u>		<u>INSTITUTIONS REPRESENTED</u>
1. Captain Briggs	Chairman	Nigerian Institute of Safety Professionals, Port Harcourt, Rivers State.
2. Engr. P.A. Oloyede	Member	Dept. of Industrial Safety, Kaduna Polytechnic 08037850822
3. Chief Nwasike	Member	Dept. of Industrial Safety, Petroleum Training Institute, Effurun.
4. Engr. J.O. Falade	Member	NBTE, Kaduna
5. Engr. E.I.E. Onyeocha	Member	NBTE, Kaduna
6. Engr. Shua'ib Y. Ringim	Member	NBTE, Kaduna
7. Mrs. Julie Molokwu	Member	NBTE, Kaduna