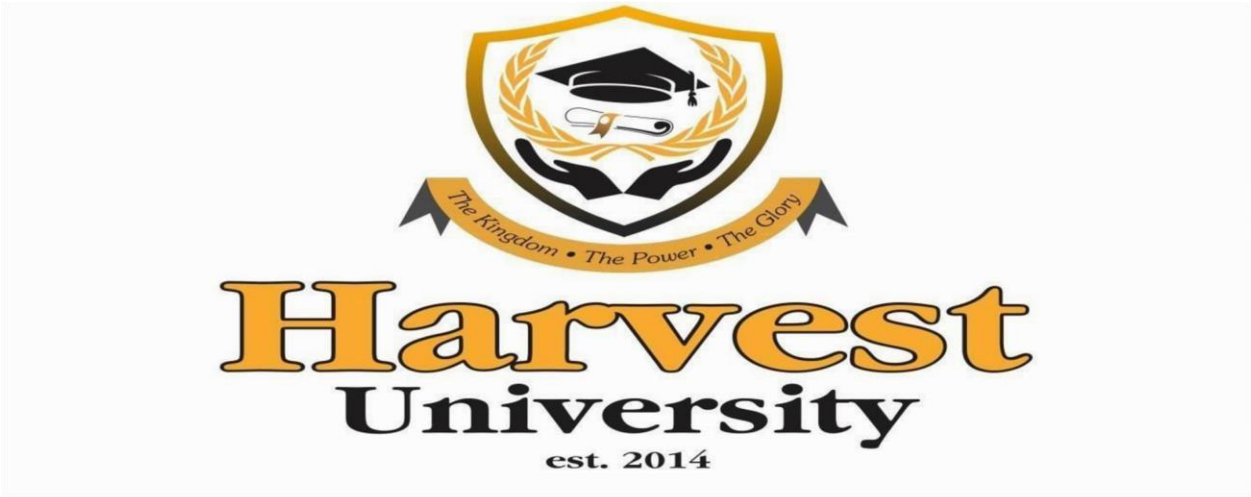

School of Health Sciences

Department of Public Health

Curriculum for Bachelor of Science in Environmental Health (BSc.EH)

Harvest University

The Kingdom. The Power. The Glory

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

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ABBREVIATIONS AND ACRONYMS

HU:	Harvest University
PBEHP	Professional Board of Environmental Health Practitioners
IHRs:	International Health Regulations
PHAST:	Participatory Hygiene and Sanitation Transformation
AIDS:	Acquired Immune Deficiency Syndrome
BAT:	Best Available Technology
CAP:	Chapter
CHAZ:	Churches Health Association of Zambia
FAMS:	Financial Accounting Management System
GHP:	Good Hygiene Practice
GMP:	Good Manufacturing Practice
HACCP:	Hazard Analysis Critical Control Point
HIV:	Human Immune Virus
HOD:	Head of Department
HPCZ:	Health Professions Council of Zambia
LAMU:	Lusaka Apex Medical University
MOH:	Ministry of Health
NISIR:	National Institute for Science and Industrial Research
NCDs:	Non-Communicable Diseases
SPSS:	Statistical package for Social Sciences
EPI INFO:	Epidemiological information
SWOT:	Strengths, Weaknesses, Opportunities and Threats

1.0 INTRODUCTION

Globally, there is ample evidence that environmental health professionals are essential for leading health systems and programmes into curtailing the causes of ill – health arising from poor environmental management and other factors found in the environment. It is also well known that in order to tackle the burden of ill health at population level, increased numbers of public health professionals are required to strengthen health systems and manage the bottlenecks. Research and practice efforts have defined the role of the public health profession as that of a multi-disciplinary team of personnel with technical skills and responsibility for leading health systems at all levels to improve health through a population focus.

Environmental Health is an ART and SCIENCE that looks at preventing diseases, prolonging life, promoting health and efficiency through organized Community effort. Environmental health is one of the most important elements of health promotion in Zambia. The following definition is provided by World Health Organisation:

"Environmental Health comprises those aspects of human health, including quality of life that is determined by physical, biological, chemical and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, and controlling and preventing those factors in the environment that can potentially affect adversely the health of the present and future generations" (Sofia, 1993).

This necessitates the academic study and development of skills in applying specialised knowledge in practical situations to safeguard the quality of the air we breathe, the food we eat, the water we drink, the places in which we live, work and play, the environment of our surrounding, our safety at work, the control of vectors of disease and other pests, as well as playing a pro-active role in the attainment of good health, defined as "not only freedom from disease but the state of complete physical, mental and social well being

The environmental health practitioner operates under various legal frame works where s/he derives powers. It is therefore imperative that the officers should be given adequate training in order to equip them with adequate knowledge and skills to apply these powers in the execution of their duties. The consequence of this is the general improvement of environmental health standards and the health status of the general public in Zambia. This curriculum is therefore designed in such a

way that after training, the graduate will have acquired knowledge, attitudes and practical skills in the science and art of preventing disease, prolonging life and promoting physical, social and mental well-being.

To cope with these continuing ethical, technical and scientific developments, many countries including Zambia have found it appropriate to advance the training of their officers responsible for environmental health, food safety and occupational health and safety control from diploma to Bachelor of Science in Environmental Health. The graduate will also be able to interpret and advise on aspects of human health including quality of life that is determined by physical, biological, social and psychosocial factors in the environment. In so doing s/he will be able to assess, correct, control and prevent those factors in the environment that can potentially or adversely affect people's health.

Perhaps the most important advancement has arisen from the necessity of preserving the biodiversity of the global environment, which has been universally recognised, and new concepts developed in ecological awareness. In workplaces stricter controls have been introduced to protect workers while handling toxic materials or undertaking physically strenuous tasks. Higher standards have been set for lighting, ventilation and extraction of fumes and particles, protection of dangerous machinery, protective clothing and equipment, and proper training of workers and staff facilities. Workers welfare is now accepted as an important management responsibility.

2.0 PROGRAMME MISSION STATEMENT AND VISION

2.1 Mission Statement

Harvest University is committed to creating and enriching the academic, personal and professional growth and at the same time disseminating knowledge leading to academic and research excellence along with developing individuals for a better tomorrow.

2.2 Vision

Harvest University thrives on Christian values and fosters lifelong academic excellence. In this regard, Harvest University strives to move towards becoming a world-class university with a

transformative impact on society and economic development through continual innovation in higher education, research, creativity and entrepreneurship.

3.0 INSTITUTIONAL VALUES

Harvest University underpins and upholds the following values in the provision of tertiary education:

3.1. Quality and Excellence:

Harvest University is committed to providing quality product or service and excellence in all disciplines that fall under its jurisdiction. The Harvest University believes in the provision of the service that is excellent, adequate, dependable and economic to students. In providing this mandate, it calls for hard work by students, lecturers and supportive staff of Harvest University

3.2 Integrity, Trust, and Respect:

Harvest University is committed to ensuring trust and respect for all persons in an environment becomes an integral part of our leadership. As an institution that cultivates Christian values, Harvest University strives to achieve institutional integrity in providing higher education to local and international students.

3.3 Research, Innovation, and Creativity:

Harvest University is committed to the pursuit of inquiry and discovery and to the creation and dissemination of knowledge.

3.4 Freedom of Expression:

Harvest University is committed to the free exchange of ideas in a constructive and civil environment, including the canons of academic freedom in research, teaching, and outreach.

3.5 Stewardship and Accountability:

The Harvest University is committed to serving as ethical and responsible stewards of University resources. In order to achieve good corporate governance and quality assurance in managing human and other resources, transparent and prudent decisions are key to the growth of the university.

4.0 PROGRAMME AIM AND OBJECTIVES

4.1 Aim of the programme

The curriculum aims at developing environmental health practitioners who will be fully equipped in both social and scientific approaches to organize an effective environmental health service and to promote the health of humankind through evidence based practice and interventions to a level where environmental factors harmful to human health cease to be a public health problem.

4.2 Programme Objectives

The programme objectives will enable student to develop abilities to:

4.2.1 Demonstrate the understanding of the principles of environmental science to manage the ecological balance, the impact of unsustainable development on bio-diversity and conservation of the environment

4.2.2 Illustrate how social factors relate to environmental health issues.

4.2.3 Apply principles of environmental management to mitigate environmental pollution.

4.2.4 Demonstrate the application of knowledge and skills in the identification, prevention and control of communicable and non-communicable diseases

4.2.5 Inspect food and food premises in order to prevent fraud and food borne diseases.

4.2.6 Demonstrate the basic principles relevant to the management of environmental and occupational health.

4.2.7 Demonstrate the necessary knowledge and skills in the identification, management and control of pests and vectors of public health importance.

4.2.8 Use scientific technology in the planning and construction of built environment and legislation related to building hygiene and services in both rural and urban areas.

4.1.9 Describe the evolution of environmental health and its relevance to current standards and legislation.

4.1.10 Interpret the basic principles of Environmental Health law, the legal system, the structure of government and government systems.

4.1.11 Identify and evaluate environmental health needs.

4.1.12 Develop strategies for mitigating environmental needs.

4.1.13 Promote stakeholder participation.

5.0 PROGRAMME LEARNING OUTCOMES

Graduates of the BSc in Environmental Health will be expected to possess the following competences in order for them to be able to adapt and work in the entire health service sector in achieving the set health objectives:

5.1 Investigate and diagnose environmental health needs and hazards in the community

5.2 Monitor health status of populations to identify health needs

5.3 Provide timely advice in the field of environmental health services to facilitate informed decision making

5.4 Design environmental monitoring strategies or programmes that aim at addressing water, soil and air pollution in order to provide insights on the source of the contaminants recorded by monitoring devices for decision making

5.5 Assess methods for collection, treatment, and disposal of waste to take appropriate sustainable approaches that promote hygienic practices

5.6 Inform, educate and empower people about environmental health issues

5.7 Mobilise community partnerships to identify and solve environmental health needs

5.8 Develop policies and plans that support individual and community health efforts

5.9 Enforce laws and regulations that protect environmental health and ensure public safety

5.10 Conduct periodic inspections to determine the suitability of built environment and take appropriate measures

5.11 Link people to the much needed personal health services and assure the provision of health care when otherwise unavailable

5.12 Assure a competent environmental health service workforce

5.13 Evaluate effectiveness, accessibility and quality of personal and population based health services

5.14 Apply port health principles and procedures in executing various functions at Port Health facilities and ground crossings in order to prevent, control or eliminate diseases of trans- boundary nature

5.15 Conduct research on environmental health issues, concerns and interventions

5.16 Design environmental monitoring strategies or programmes that establishes the trends in the environmental parameters or provide insights on the source of contaminants for abatement management

6.0 PROGRAMME ENTRY REQUIREMENTS

6.1 Level 1 – First year entry: Applicants must have passed five 'O' level passes at credit level or better in English Language, Mathematics, Biology/Agricultural science, Science or Chemistry and Physics, and any other subject.

6.2 Level 2 - Second year entry:

6.2.1 Applicants must have passed 'A' level passes with a minimum grade of C+ in Biology, Chemistry, Physics and Mathematics from recognised higher learning institution.

6.2.2 Applicants with Diploma in Public Health or Diploma in any health related field with a minimum of five 'O' levels at credit level or better in English Language, Mathematics, Biology/Agricultural Science, Science or Chemistry and Physics, and any other subject.

6.3 Level 3 - Third year entry: Applicants with Diploma in Environmental Health with a minimum of five 'O' levels at credit level or better in English Language, Mathematics, Biology/Agricultural Science, Science or Chemistry and Physics, and any other subject.

KEY NOTE: Entry to Levels 2 and 3: Harvest University will scrutinize the qualifications of each applicant and determine the level of entry or course exemptions.

7.0 CURRICULUM MODEL

7.1 This curriculum consists of taught theoretical courses with practical laboratory experience and field exposure to practicum sites to strengthen and match with current approaches in scientific methods. There will be community based learning and practice in later years of training in order to strengthen students' knowledge, skills and attitudes. The community placements will be conducted with institutions where we have memorandum of understanding. This curriculum offers to provide a student-centred learning approach through a problem based learning approach in a resource constrained environment, as is mostly the case in Zambia.

7.2 Ideally, curriculum models in theory are described as traditional, integrated, hybrid or spiral. The Trinity University curriculum on Environmental Health is designed with traditional model in mind and taking into consideration available limited resources. The curriculum is planned in such a way that the traditional approach is taken care of by ensuring that students study the "A" levels then move on to core environmental health courses. Even though noncore courses such as Computer skills, Academic writing skills, Communication skills, Ethics, Christian values, may be taught separately, they will be implicitly taught within the core environmental health courses.

8.0 CURRICULUM STRUCTURE

Environmental Health professionals have traditionally acquired a wide range of knowledge and skills that need to be applied in specific circumstances. It is this diverse body of knowledge that allows for the efficient and cost effective handling of a wide range of environmental, food safety and occupational health issues. The management of the programme should appreciate the interrelationship that exists between these disciplines and teaching programmes, training opportunities and mode of study should be designed to reflect that. In laying out the curriculum specialist areas of environmental health studies have been programmed into five core themes of environmental health studies and an overarching theme, each of which is so structured as to ensure that topics are studied at appropriate stages in the progressive development of the student's knowledge. The themes are: -

8.1 Pollution Control.

8.2 Occupational Health and Safety.

8.3 Community Health.

8.4 The Built Environment.

8.5 Food Safety.

8.6 Cross cutting/Overarching Courses.

These subject areas of the programme have been designed and located to provide the students with a learning experience which addresses these core themes at each level and progresses them appropriately from one level to the next. The sixth theme shows how certain subjects provide integration of the themes throughout the programme. It is of paramount importance that the curriculum is carried out with the primary focus on the holistic concept of environmental, food safety and occupational health and safety stratagem.

9.0 METHOD OF DELIVERY

9.1 Full time delivery

9.2 Part time delivery

9.3 Online distance learning delivery

10.0 LEVEL OF QUALIFICATION AND ARTICULATION IN THE ZAMBIA QUALIFICATIONS FRAMEWORK: ZQ LEVEL 7

11.0 CURRICULUM STRUCTURE

Table 1: The curriculum structure

Course Code	Course Title	Assessment Criteria			
	First Year Courses ('A' levels)	**CA (%)**	**Theory Exam (%)**	**Practical Exam (%)**	**Total (%)**
	First semester of the first year				
P 111	Introductory Physics I	40	40	20	100
M112	Mathematical Methods I	40	60	--	100
C 113	Introductory Chemistry I	40	40	20	100
B 114	Biological Sciences I	40	40	20	100
	Second semester of the first year A' (' levels)				
P 121	Introductory Physics II	40	40	20	100
M122	Mathematical Methods II	40	60	--	100
C 123	Introductory Chemistry II	40	40	20	100
B 124	Biological Sciences II	40	40	20	100
	Second Year Courses				
	First semester of the second year				
EHS 211	Applied Human Physiology and Anatomy	40	40	20	100
EHS 212	Applied Microbiology, Virology and Parasitology	40	40	20	100
EHS 213	Food Chemistry and Nutrition	40	40	20	100
EHS 214	Environmental Science	40	60	--	100
EHS 215	Information Technology and Communication Skills	40	40	20	100
	Second semester of the second year				
EHS 221	Introduction to Environmental Health	40	60	--	100
EHS 222	Sanitation and Hygiene	40	40	20	100

EHS 223	Water Supply	40	40	20	100
EHS 224	Solid Waste and Health Care Waste Management	40	60	--	100
EHS 225	Medical Entomology	40	40	20	100
	Third Year Courses				
	First semester of the third year				
EHS 311	Principles of Building Design and Building Construction	40	40	20	100
EHS 312	Communicable and Non-Communicable Diseases	40	60	--	100
EHS 313	Introduction to Principles of Law	40	40	20	100
EHS 314	Health Promotion and Behavioural Change	40	60	--	100
EHS 315	Practical Training I	40	--	60	100
	Second semester of the third year				
EHS 321	Planned Development and Building Services	40	40	20	100
EHS 322	Anatomy and Physiology of Food Animals	40	40	20	100
EHS 323	Toxicology and Chemical Safety	40	60	--	100
EHS 324	Slaughtering and Slaughter Houses	40	40	20	100
EHS 325	Inspection of Premises and Reporting	20	30	50	100
	Fourth Year Courses				
	First semester of the fourth year				
EHS 411	Principles of Occupational Health and Safety	40	40	20	100
EHS 412	Epidemiology	40	40	20	100
EHS 413	Food Safety and Food Inspections	40	40	20	100
EHS 414	Integrated Disease Surveillance and Port Health	40	40	20	100
EHS 415	Biostatistics	40	40	20	100
EHS 416	Practical Training II	20	--	60	100

	Second semester of the fourth year				
EHS 421	Meat Pathology and Meat Inspection	40	40	20	100
EHS 422	Occupational Hazards and Risk Analysis	40	40	20	100
EHS 423	Environmental Monitoring and Pollution Control	40	40	20	100
EHS 424	Research Methods	40	30	30	100
EHS 425	Industrial Training	40	--	60	100
	Fifth Year Courses				
	First semester of the fifth year				
EHS 511	Geographical Information System and Remote Sensing in Public Health	40	40	20	100
EHS 512	Risk Assessment and Management	40	40	20	100
EHS 513	Strategic Public Relations and Ethics	40	40	20	100
EHS 514	Prosecutions and Enforcement for Public Health Protection	40	40	20	100
EHS 515	Radiation Protection and Nuclear Safety	40	40	20	100
EHS 516	Research Project	-	-	100	
	Second semester of the fifth year				
EHS 521	Environmental Epidemiology	40	60	--	100
EHS 522	Project Planning, Monitoring and Evaluation	40	60	--	100
EHS 523	Climate Change and Disaster Risk Reduction	40	60	--	100
EHS 524	Environmental Health Administration and Financial Management	40	60	--	100
EHS 525	Environmental Economics	40	60	--	100

Coding system

The explanation for the coding system is as follows:-

Letters: These denote abbreviations of the course

Figures: Figure No. 1 - denotes year in which the course is offered.
Figure No. 2 - denote semester in which the course is offered
Figure No. 3 - denote the number of series of the course in the semester.

12.0 CURRICULUM MAP

Table 2: Curriculum Map

	Semester 1						**Semester 2**					
	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept
Year 1	**''A'' LEVEL COURSES**											
	Introductory Physics I						Introductory Physics II					
	Mathematical Methods I						Mathematical Methods II					
	Introductory Chemistry I						Introductory Chemistry II					
	Biological Sciences I						Biological Sciences II					
	PROFESSIONAL COURSES											
Year 2	Applied Human Physiology and Anatomy						Introduction to Environmental Health					
	Applied Microbiology, Virology and Parasitology						Sanitation and Hygiene					
	Food Chemistry and Nutrition						Water Supply					
	Environmental Science						Solid Waste Management and Health Care Management					
	Information Technology and Communication Skills						Medical Entomology					
Year 3	Principles of Building Design and Building Construction						Planned Development and Building Services					
	Communicable and Non-communicable Diseases						Anatomy and Physiology of Food Animals					
	Integrated Disease Surveillance and Port Health						Toxicology and Chemical Safety					
	Health Promotion and Behavioural Change						Slaughtering and Slaughter Houses					
	Practical Training I						Inspection of Premises and Reporting					
Year 4	Principles of Occupational Health and Safety						Meat Pathology and Meat Inspection					
	Epidemiology						Occupational Hazards and Risk Analysis					
	Food Safety and Hygiene and Food Inspections						Environmental Monitoring and Pollution Control					
	Integrated Disease Surveillance and Port Health						Research Methods					

	Biostatistics	Industrial Training
	Practical Training II	
Year 5	Geographical Information System and Remote Sensing in Public Health	Environmental Epidemiology
	Risk Assessment and Management	Project Planning, Monitoring and Evaluation
	Strategic Public Relations and Ethics	Climate Change and Disaster Risk Reduction
	Prosecution for Public Health Protection	Environmental Health Administration and Financial Management
	Nuclear and Radiation Safety	Environmental Economics
	Research project	

13.0 TEACHING AND LEARNING PLAN

Table 3: Teaching and Learning Plan

First Year Courses (BSc in Environmental Health)

CODE	COURSE TITLE	HOURS OF LEARNING (IN WEEKS)													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Fieldwork		Assessments and Self Study		Total Notional Hours	
		Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks		
P111	Introductory Physics I	3	15	2	15	2	15	-	-	-	-	3	15	150	15
M112	Mathematical Methods I	3	15	2	15			-	-	-	-	5	15	150	15
C113	Introductory Chemistry I	3	15	2	15	2	15	-	-	-	-	3	15	150	15
B114	Biological Sciences I	3	15	2	15	2	15	-	-	-	-	3	15	150	15
P121	Introductory Physics II	3	15	2	15	2	15	-	-	-	-	3	15	150	15
M122	Mathematical Methods II	3	15	2	15			-	-	-	-	5	15	150	15
C123	Introductory Chemistry II	3	15	2	15	2	15	-	-	-	-	3	15	150	15
B124	Biological Sciences II	3	15	2	15	2	15	-	-	-	-	3	15	150	15
Total														**1200**	**120**

Second Year Courses

COURSE CODE	COURSE TITLE	HOURS OF LEARNING													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Fieldwork		Assessments and Self Study		Total Notional Hours	
		Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks		
EHS 211	Applied Human Anatomy and Physiology	3	15	2	15	2	15	-	-	-	-	3	15	150	15
EHS 212	Applied Microbiology, Virology and Parasitology	3	15	2	15	2	15	-	-	-	-	3	15	150	15
EHS 213	Food Chemistry and Nutrition	3	15	1	15	1	10	-	-	-	-	1	10	80	8
EHS 214	Environmental Science	3	15	1	15	-	-	1	10	2	10	1	10	100	10
EHS 215	Information Technology and Communication Skills	3	15	2	15	2	15	-	-	-	-	1	15	120	12
EHS 221	Introduction to Environmental Health	3	15	1	15	-	-	1	10	-	-	2	10	80	8
EHS222	Sanitation and Hygiene	3	15	1	15	-	-	3	10	-	-	2	15	120	12
EHS 223	Water Supply	3	15	2	15	2	15	-	-	2	10	2	15	150	15
EHS 224	Solid Waste and Health Care Waste Management	3	15	1	15	2	10	-	-	2	10	1	15	150	15
EHS 225	Medical Entomology	3	15	2	15	-	-	2	15	-	-	3	15	100	10
Total														**1200**	**120**

Third Year Courses

COURSE CODE	COURSE TITLE	HOURS OF LEARNING													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Fieldwork		Assessments and Self Study		Total Notional Hours	
		Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks		
EHS 311	Principles of Building Design and Building Construction	3	15	1	15	-	-	-	-	3	10	2	15	120	12
EHS 312	Communicable and Non-Communicable Diseases	3	15	1	15	-	-	-	-	3	10	2	15	120	12
EHS 313	Introduction to Principles of Law	3	15	1	15			1	10	-	-	1	10	80	8
EHS 314	Health Promotion and Behavioural Change	3	15	1	15	-	-	1	10	-	-	3	10	100	10
EHS 315	Practical Training I	-	-	-	-	-	-	-	-	40	5	1	10	210	21
EHS 321	Planned Development and Building Services	3	15	1	15	-	-	-	-	3	10	1	10	100	10
EHS 322	Anatomy and Physiology of Food Animals	3	15	2	15	2	15	-	-	-	-	3	15	150	15
EHS 323	Toxicology and Chemical Safety	3	15	1	15	-	-	-	-	2	5	3	10	100	10
EHS 324	Slaughtering and Slaughter Houses	3	15	-	-	-	-	-	-	1	15	1	10	70	7
EHS 325	Inspection of Premises and Reporting	3	15	1	15	-	-	-	-	3	15	3	15	150	15
Total														**1200**	**120**

Fourth Year Courses

COURSE CODE	COURSE TITLE	HOURS OF LEARNING													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Fieldwork		Assessments and Self Study		Total Notional Hours	
		Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks		
EHS 411	Principles of Occupational Health and Safety	3	15	1	15	3	5	-	-	1	5	1	10	90	9
EHS 412	Epidemiology	3	15	1	15	-	-		-	-	-	1	10	70	7
EHS 413	Food Safety and Food Inspections	3	15	1	15	-	-	-	-	3	5	2	15	90	9
EHS 414	Integrated Disease Surveillance and Port Health	3	15	1	15	-	-	-	-	3	5	1	15	90	9
EHS 415	Biostatistics	3	15	1	15	-	-	-	-	-	-	2	15	90	9
EHS 416	Practical Training II	-	-	-	-	-	-	-	-	40	5	1	10	210	21
EHS 421	Meat Pathology and Meat Inspection	3	15	1	15	1	15	-	-	3	5	1	10	100	10
EHS 422	Occupational Hazards and Risk Analysis	3	15	1	15			-	-	-	-	2	10	80	8
EHS 423	Environmental Monitoring and Pollution Control	3	15	1	15	3	5	-	-	1	5	1	10	90	9
EHS 424	Research Methods	3	15	1	15	-	-	-	-			2	15	80	8
EHS 425	Industrial Training	-	-	-	-	-	-	-	-	40	5	1	10	210	21
Total														**1200**	**120**

Fifth Year Courses

COURSE CODE	COURSE TITLE	HOURS OF LEARNING													CREDIT POINTS
		Lectures		Tutorials		Laboratory		Seminars		Fieldwork		Assessments and Self Study		Total Notional Hours	
		Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks	Hrs/ wk	No. of wks		
EHS 511	Geographical Information System and Remote Sensing in Public Health	3	15	1	15	2	15	-	-	-	-	2	10	110	11
EHS 512	Risk Assessment and Management	3	15	1	15	-	-	-	-	3	5	1	15	90	9
EHS 513	Strategic Public Relations and Ethics	3	15	1	15	-	-	1	10	-	-	1	10	80	8
EHS 514	Prosecutions and Enforcement for Public Health Protection	3	15	1	15	-	-	1	10	8	5	2	15	140	14
EHS 515	Radiation Protection and Nuclear Safety	3	15	1	15	1	15	-	-	3	5	1	10	100	10
EHS 516	Research Project	-	-	-	-	-	-	-	-	40	5	1	10	210	21
EHS 521	Environmental Epidemiology	3	15	1	15	-	-	-	-	2	5	1	10	80	8
EHS 522	Project Planning, Monitoring and Evaluation	3	15	1	15	-	-	1	15	3	5	2	10	110	11
EHS 523	Climate Change and Disaster Risk Reduction	3	15	1	15	-	-	1	10	3	5	1	15	100	10
EHS 524	Environmental Health Administration and Financial Management	3	15	1	15	-	-	1	10	2	10	1	10	100	10
EHS 525	Environmental Economics	3	15	1	15	-	-	1	10	-	-	1	10	80	8
Total														**1200**	**120**

14.0 PROGRESSION CRITERIA

The progression criteria for Bachelor of Science in Environmental Health Programme are based on the School of Health Sciences of the Harvest University. A student will progress to the next level upon having passed all courses in the current level of study.

14.1 Grading System in the BSc in Environmental Health

Table 4: Numerical conventional and criteria

Grade	Mark	Class	GPA
Distinction	90 and above	A+	4.0
Distinction	80 – 89	A	3.7
Merit	70 – 79	B+	3.3
Credit	60 – 69	B	3.0
Definite pass	55 – 59	C+	2.7
Bare pass	50 – 54	C	2.0
Bare fail	45 – 49	D+	1.3
Clear fail	40 – 44	D	1.0
Definite fail	Below 39	E	0.0

14.2 Regulations for writing supplementary examinations, repeating the semester and exclusion from the programme

14.2.1 ''A'' Level courses: First Year

1. There are four courses in each semester.
2. Student who obtains grade D+ in one course and passes other courses will be required to write supplementary examination in the course(s) failed provided continuous assessment is passed.
3. The following criteria shall apply for repeat semester:
   3.1 Grade D+ in one course with failed continuous assessment.
   3.2 Grade D+s in two courses
   3.3 Grade D in one course
   3.4 Failure in supplementary examinations
4. A student may repeat a semester only once.
5. Continuous assessment shall carry 50% of the total final grade in each course.
6. The final examination in each course shall constitute 50%.

7. A student shall be deemed to have passed end of semester examination if s/he obtains 50% or more in each course which includes continuous assessment and final examination. 8. A student who passes supplementary examinations shall be awarded a grade of P for pass.
9. Exclusion from the Programme: The following criteria shall apply for exclusion from the programme:
   9.1 Failure with one D and one D+.
   9.2 Failure with D in two courses.
   9.3 Failure in more than two courses
   9.4 Failure of a repeated semester.

14.2.2 Professional Courses: Second Year to Fifth year courses

1. There are five courses in each semester.
2. A student who obtains grade D in one (1) course or grade D+ in two (2) courses and passes the other courses will be required to write supplementary examination in the courses failed provided continuous assessment is passed.
3. A student who obtains grade D in three (3) courses or fails supplementary examination will be required to repeat the semester. The following criteria shall apply for repeat semester:
   3.1 Grade D+ in two courses with failed continuous assessment
   3.2 Grade D+ in three courses with passed continuous assessment
   3.3 Grade D in two courses
   3.4 Failure in supplementary examinations.
4. A student may repeat a semester only once.
5. Continuous assessment shall carry 40% of the total final grade in each course.
6. The final examination in each course shall constitute 60%.
7. A student shall be deemed to have passed end of semester examination if s/he obtains 50% or more in each course which includes continuous assessment and final examination.
8. A student who passes supplementary examinations shall be awarded a grade of P for pass.
9. Exclusion from the Programme: The following criteria shall apply for exclusion from the programme:
   9.1 Failure with two Ds and one D+.
   9.2 Failure with D in three courses.
   9.3 Failure in more than three courses
   9.4 Failure of a repeated semester.

15.0 LINKAGES WITH EXTERNAL INSTITUTIONS

Harvest University shall accept application of affiliation from academic institutions such as universities and colleges; provided that such institution(s) meets the university's criteria of affiliation. A Memorandum of Agreement shall be entered into and signed by two parties, namely, The Harvest University and the university/college concerned in which areas of collaboration shall be spelt out.

YEAR ONE SEMESTER ONE

Course codes	Course Titles
P111	Introductory Physics I
M112	Mathematical Methods I
C113	Introductory Chemistry I
B114	Biological Sciences I

COURSE TITLE: INTRODUCTORY PHYSICS I
COURSE CODE: P111

INTRODUCTION

In the modern world of science and technology advancement, it is imperative that students are equipped with some basic concepts of classical and modern physics to enable them understand the dynamics of physical processes, properties, structure of the land on which humans and other living organisms live. This approach enables students to grasp how the earth functions in relation to energy interactions such as gravity, magnetic, electrical interactions, and therefore integration of mathematics, geology and physics helps to understand how the earth functions.

COURSE AIM:

The course aims at equipping students with fundamental knowledge and a sound understanding of physics together with practical, analytical skills that enable them apply to manage environmental health parameters.

COURSE OBJECTIVES:

1. Correctly solve problems applying important concepts in measurements, vector analysis, rotational work, linear momentum, motion in a circle, energy and momentum
2. Explain Newton's Law
3. Explain laws of physics and calculate mathematical problems based on the laws
4. Describe the physical dynamics that are applicable in the control of mechanical, chemical and radio-isotope processes
5. Explain the laws of physics and calculated mathematical problems based on the laws
6. Elucidate the physical dynamics that apply and control mechanical, chemical and radio-isotope processes

COURSE LEARNING OUTCOMES

1. Demonstrate understanding of physical dynamics that apply and control mechanical, chemical and radio-isotope processes
2. Use principles of physics in the analysis, control and management of environmental issues.
3. Apply quantitative reasoning and appropriate mathematical calculations in physics to describe or explain phenomena in the natural world
4. Demonstrate knowledge of basic physical principles and their applications to the applications to the understanding of living systems
5. Demonstrate understanding of mechanics as applied to human and diagnostic systems

COURSE CONTENT:

1.0 Vectors:

1.1 Vectors and scalars
1.2 Vector addition and subtraction
1.3 Vector components;
1.4 Addition of vectors by components.

2.0 Description of motion:

2.1 Speed and velocity;
2.2 Instantaneous velocity
2.3 Displacement
2.4 Acceleration; Uniformly accelerated motion
2.5 Time and acceleration
2.6 Acceleration of gravity
2.7 Projectile motion.

3.0 Newton's laws of motion:

3.1 First law of motion
3.2 Inertia and mass
3.3 Force
3.4 Second law of motion
3.5 Action and reaction
3.6 Third law of motion
3.7 Mass and weight
3.8 Frictional forces
3.9 Coefficients of friction
3.10 Weightlessness.

4.0 Work and Energy:

4.1 Work
4.2 Power; Energy
4.3 Work/energy theorem
4.4 Kinetic and potential energy
4.5 Conservation of energy
4.6 Conservative and non-conservative forces.

5.0 Linear momentum:

5.1 Linear momentum
5.2 Conservation of linear momentum
5.3 Elastic and inelastic collisions
5.4 Impulse
5.5 Rocket propulsion.

6.0 Rotational motion:
6.1 Angular measure
6.2 Angular speed and acceleration
6.3 Centripetal acceleration and force
6.4 Equations of motion
6.5 Law of gravitation; Gravitation and weight; Weightlessness
6.6 Orbital motion

.

7.0 Rotational work, energy, and momentum:
7.1 Rotational work and kinetic energy
7.2 Moment of inertia
7.3 Torque
7.4 Angular momentum
7.5 Combined rotation and translation.

8.0 Equilibrium:
8.1 Translational equilibrium
8.2 8.2 Rotational equilibrium
8.3 Centre of gravity.

9.0 Mechanical properties of matter:
9.1 Density

9.2 Hooke's law

9.3 Young's modulus
9.4 Shear, and Bulk modulus
9.5 Pressure and depth

9.6 Archimedes' principle **9.7** Buoyancy.

10.0 Pressure and temperature of a gas:
10.1 Atmospheric pressure
10.2 Barometers, Thermometers and Temperature scales
10.3 Ideal gas law.

11.0 Practical Physics and Investigative Skills

TEACHING METHODS
1. Lectures and Tutorials
2. Practical/Laboratory
3. Demonstrations

4. Group discussions

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.1 Continuous assessment 50%
1.2 2 Tests (theory) 20%
1.3 2 Assignments/Tutorial quizzes 5%
1.4 Laboratory work 15%
1.5 Practical/Lab test 10%

1.1 **Final Examinations 50%**
1.2.1 Theory 50%

PRESCRIBED READINGS:

1. Rarmond, A, Emeritus, J, et al. (2019) Physics For Scientists and Engineers. 10th ed. UK: Cengage Learning.
2. DK, Jim Al-Khalili. (2020). **The Physics Book**. DK Publishers Portsmouth, England

RECOMMENDED READINGS

1. Meredithand, D.C. and Redish, E.F. (2013). **Re-inventing physics for life-sciences majors**. Phys. Today 66(7), 38

COURSE TITLE: MATHEMATICAL METHODS I
COURSE CODE: M112

INTRODUCTION

Knowledge and understanding are fundamental to studying mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.

COURSE AIM:

The course aims at equipping students with mathematical skills in foundation subjects, namely, set theory, elementary algebra, elementary functions and elementary calculus

COURSE OBJECTIVES:

1. Correctly solve problems applying important concepts in set theory and transcendental functions including equations and partial fractions
2. Solve problems in elementary differential calculus, elementary functions and explain their properties
3. Think logically, analytically, and abstractly
4. Communicate mathematics, both orally and in writing

COURSE LEARNING OUTCOMES

1. Develop mathematical curiosity and use inductive and deductive reasoning when solving problems
2. Develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others
3. Develop a critical appreciation of the use of information and communication technology in mathematics
4. Use appropriate mathematical concepts and skills to analyse solve problems in both familiar and unfamiliar situations including those in real-life contexts

COURSE CONTENT

1.0 Sets

1.1 Sets Theory: Definitions; subsets; set operations; De Morgan's laws; Sets of numbers:
1.2 Natural numbers; integers; rational numbers; real numbers; complex numbers; arithmetic operations on complex numbers; surds

2.0 Functions

2.1 Binary operations; relations; functions; domain and range; many-to-one function; one-to-one functions; inverse functions; composed functions; even and odd functions; Linear and quadratic functions: Completing the square; maximum and minimum values of quadratic functions; graphs of quadratic functions; applications.
2.2 Polynomials Functions: Polynomials; addition; multiplication; division; remainder theorem; factor theorem; factorisation; graphs. Rational functions: Domain; range; graphs. Modulus Functions: Domain; range of; graphs. Radical functions: Domain; range; graphs.

3.0 Equations and Inequalities

3.1 Equations: Quadratic; polynomials; involving radicals, quotients and absolute value; system of equations in two and three unknowns. Inequalities: Linear; quadratic; polynomials; involving quotients and absolute value.

4.0 Partial Fractions

4.1 Denominator with: linear factors none of which is repeating; linear factors of which some are repeating; quadratic factors none of which is repeating; quadratic factors of which some are repeating.

5.0 Transcendental Functions

5.1 Trigonometric functions: Trigonometric ratios; ratios of angles; degrees and radian measure; trigonometric functions; domain; graphs; identities; trigonometric equations.
5.2 Inverse trigonometric functions: Domain and range; graphs. Exponential and logarithmic functions: Domain and range; graphs; their properties; inverses; equations.

6.0 Differential Calculus

6.1 Limits: Limits of a function; continuity of a function; differentiation of function from first principle; differentiation by formula; sum; product rule; quotient rule; chain rule; implicit differentiation; derivatives of Exponential and logarithmic functions; derivatives of Inverse trigonometric functions.

TEACHING METHODS

1. Lectures
2. Tutorials
3. Practical
4. Demonstrations
5. Group discussions

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Assessment and self-study: 5 hours per week

ASSESSMENT METHODS

1.0 **Continuous assessment**	**40%**
1.1 2 Tests	40%
1.0 **Final Examinations**	**60%**
1.1 Theory	60%

PRESCRIBED READINGS:

1. M. Liebeck (2015). **A Concise Introduction to Pure Mathematics**. 3rd ed. UK: Chapman and Hall/ CRC.
2. Gilderdale, A, Haese, S, et al. (2018). **Cambridge Additional Mathematics**. 2nd ed. UK: Haese Mathematics.

RECOMMENDED READINGS

1. Nicholson, S, Ransom, P, et al (2018). **Additional Math Student Book** 1st ed. UK. Collens Publisher.

COURSE TITLE: INTRODUCTORY CHEMISTRY I
COURSE CODE: C114

INTRODUCTION

The course prepares students in basic inorganic, analytical, organic and physical chemistry. The course provides an understanding of the link between theory and experiment as well as imparts the essential knowledge and understanding of different areas of chemical processes and how they relate to each other.

COURSE AIM:

The course provides students with the foundation of general chemistry in order to impart experimental skills to students in organic, analytical, organic and physical chemistry necessary to make scientific decisions that benefit mankind.

COURSE OBJECTIVES:

1. Demonstrate an understanding of different areas of chemistry and how they relate to each other.
2. Elucidate general principles of solubility and colligate properties of solutions
3. Develop and demonstrate a deeper understanding of the molecular structure and the periodic table
4. Explain and predict the chemical bonding, and chemical structure and shape of, simple molecules
5. Use theories, models and ideas to develop and modify scientific explanations in chemistry 6. Write basic chemical formulae, and equations.
7. Calculate chemical quantities
8. Describe intermolecular forces and sketch and interpret simple phase diagrams.

COURSE LEARNING OUTCOMES

1. Perform stoichiometric calculations and write acid -base, precipitation and redox reactions
2. Apply the ideal gas and use to kinetic theory and application to real gases.
3. Demonstrate an understanding of reaction enthalpy, its determination using calorimetric and Hess "Law.
4. Demonstrate understanding of chemical formulae, reactions and equations
5. Use correct scientific methods to analyse samples for chemical properties and composition.
6. Discuss qualitatively the uncertainties/errors in chemical experiments
7. Demonstrate skills in handling equipment/glassware, in making observations, recording and analysis of data.
8. Apply the knowledge of chemistry in the handling of materials such as wastes
9. Demonstrate skills in handling simple equipment/glassware, in making observations, recording and analysis of data

10. Discuss factors influencing the rate of reaction, and apply the rate law, and Arrhenius equation.
11. Write a comprehensive report (including a critical evaluation of the results) about chemical experiments

COURSE CONTENT:

1.0 **Stoichiometry**

1.1 Measurement: Units of measurement, Uncertainty in measurement - Accuracy and

1.2 Precision, Dimensional analysis

1.3 Relative masses of atoms and molecules, determination of relative atomic masses from percentage composition, Empirical and molecular formula, combustion analysis

1.4 The mole, Avogadro's number, Quantitative information from balanced reaction, limiting reactant, theoretical yield, percentage yield.

1.2 Solution stoichiometry:

1.2.1 Types of reactions: Precipitation reaction – metathesis, Acid-base reaction - acids, bases, neutralisation reactions, acid-base reaction with gas formation

1.2.2 Oxidation - reduction reaction- oxidation, reduction, oxidation numbers, balancing redox reaction by oxidation number method and by ion electron method in acid and basic medium;

1.2.3 Concentrations of solutions: molarity, dilution,

1.2.4 Titration: simple titration, back titration and redox titration,

1.3 Gases:

1.3.1 Postulates of kinetic theory, Use kinetic theory to explain gas laws; the ideal gas behaviour and deviations from it (behaviour of real gases - the van der Waal's equation); Use of ideal gas equation in determining the molar mass

1.4 Atomic Structure and the Periodic Table

1.4.1 Atomic structure: The nucleus of the atom: neutron, proton, isotopes, proton and nucleon number, mass number; Bohr's model of atom, Rydberg's equation, Idea of de Broglie matter waves; Heisenberg uncertainty principle, atomic orbitals, quantum numbers, Aufbau and Pauli's exclusion principles. Hund's multiplicity rule; electronic configuration of elements; effective nuclear charge and shielding; shapes of s and p orbitals and their characteristics.

1.4.2 Periodic Trends: Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, trends in periodic table and applications in predicting and explaining the chemical behaviour.

1.5 Chemical Bonding

1.5.1 Ionic bond, covalent bond and coordinate bonds, Lewis structure, formal charge, directional characteristics of covalent bond Hybridization (sp, sp2, sp3) and shapes of simple molecules and ions by valence shell electron pair repulsion (VSEPR) theory, Resonance structures

1.5.2 Molecular orbitals: bond order; bond length, bond polarities, intermediate nature of bonds, dipole moment.

1.6 Electrochemistry

1.6.1 Redox process: electron transfer and change in oxidation state; Standard electrode potentials, the redox series, cell potentials under standard and non-standard conditions, the Nernst equation, concentration cells; Batteries and fuel cells

1.6.2 Corrosion; Electrolysis, factors affecting amount of substance liberated during electrolysis, The Faraday constant;

1.7. Thermochemistry

1.7.1 First and second law of Thermodynamics; Heats of reaction, Calorimetry, Enthalpy, Hess's Law, Bond Energy, Lattice Energy

1.8 Practical Chemistry and Investigative Skills

TEACHING METHODS

1. Lectures
2. Practical/Laboratory
3. Demonstrations
4. Group discussions
6. Tutorials

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**50%**
1.1 2 Tests (theory)	20%
1.2 2 Assignments/Tutorial quizzes	5%
1.3 Laboratory work	15%
1.4 Practical/Lab test	10%
1.2 Final Examinations	**50%**
1.2.1 Theory	50%

PRESCRIBED READINGS

1. Steven. S, Susan. A (2013). **Zumdal Chemistry**. 9th ed. UK. Cengage Learning Press
2. Karen. C (2017). **An Introduction to General, Organic, and Biological Chemistry**. 13th ed. Los Angles. Pearson publisher.

REECOMMENDED READINGS

1. Martin, S. (2012). **Principles of General Chemisry**. 3rd edition. New York, Mc Grow-Hill press

COURSE TITLE: BIOLOGICAL SCIENCES I
COURSE CODE: B114

INTRODUCTION

This is an introductory course to biological sciences that equips students with initial biological concepts required for higher courses and introduces students to the diversity of life and its relationship to the environment.

COURSE AIM:

The course aims at providing the foundation course that introduces students to the diversity of life at the cell level.

COURSE OBJECTIVES:

1. Explain facts, terms, principles and concept of the cell biology and elementary Genetics.
2. Explain the sources of interspecies and interspecies variations
3. Describe, draw and label anatomical structures of plant and animal tissues, organs and systems
4. Explain the functions of plant and animal tissues, organs and systems
5. Describe the function-structure relationship

COURSE LEARNING OUTCOMES

1. Demonstrate understanding of biological facts, terms, principles and concepts
2. Distinguish between cell types and describe and state the functions of the various cell organelles and other cell component.
1. Use light microcopy and other techniques in the study of cells.
2. Solving simple genetics problems such as monohybrid and dihybrid inheritances and testing the validity of such information and of experimental results by use the chi-square.
3. Demonstrate precision in practical techniques including accurate observation and recording.
4. Draw conclusions and make inferences
5. Handle, assess and evaluate non-numerical biological information
6. Accurately carry out practical, including accurate observation and recording
7. Write a concise, coherent and logical scientific report of experimental results

COURSE CONTENT

1.0 MOLECULAR BIOLOGY

1.1 Biomolecules and cells

1.1.1 Atomic theory:

1.1.1.1 Atomic structure and distribution of electrons in orbitals of selected elements (carbon, hydrogen, oxygen, nitrogen, phosphorus, sodium and chlorine);

1.1.1.2 **Covalent bonds** (in water and carbon dioxide); **non-covalent bonds** (ionic, hydrogen, hydrophobic, hydrophilic and van der Waals).

1.1.1.3 **Water:** Dipolar nature; Formation of hydrogen bonds; Importance as a solvent; Roles related to its high latent heat of vaporization, specific heat capacity, and density and surface tension

1.1.1.4 **Carbohydrates:** Structure and functions of monosaccharides, disaccharides and polysaccharides in metabolism; synthesis and hydrolysis of disaccharides (sucrose, maltose and lactose); synthesis and hydrolysis of polysaccharides (amylose, amylopectin, cellulose and glycogen).

1.1.1.5 **Lipids:** Structure of fatty acids (saturated and unsaturated); synthesis of triglycerides (formation of ester bonds); roles of lipids (energy storage, body protection, water proofing, insulation and buoyancy); synthesis of phospholipids; structure and roles in the formation of cell membranes; structure and functions of waxes in plants and animals.

1.1.1.6 **Proteins:** Structure and functions of amino acids; classification of amino acids; synthesis and hydrolysis of polypeptides (peptide bonds and their formation), Fucntions of proteins (transport, communication, structural, defence and catalysis); different levels of protein structure (primary, secondary, tertiary and quaternary); roles of ionic, hydrogen, disulphide and Van der Waals interactions in protein structure.

1.1.1.7 **Enzymes:** Concept of induced-fit site and enzyme specificity, mechanisms of enzyme action (Key and Lock and Induced-Fit hypotheses); enzymes as biological catalysts; Effects of pH, temperature, substrate and enzyme concentration on enzyme catalysis. Role of cofactors and coenzymes on enzyme activity. Effects of enzyme inhibitors (reversible and irreversible).

1.1.1.8 **Nucleic acids:** Structure of ribose, deoxyribose, phosphoric acid and nitrogenous bases (uracil, thymine, adenine, cytosine and guanine), synthesis if nucleosides and nucleosides; synthesis polynucleotides (DNA and RNA), structures and functions of DNA and RNA (mRNA, tRNA and rRNA).

1.1.1.9 **Prokaryotic cells**: Typical structure of a bacterial cell (*Escherichia coli*); structure and functions of bacterial cell wall, cell membrane (including phospholipids, proteins and oligosaccharides); chromosomal and plasmid DNA.

1.1.1.10 **Eukaryotic cells**: Structure of a typical plant (palisade) cell and a typical animal (liver) cell; functions of the cell wall, cell membrane and organelles (nucleus, ribosomes, mitochondria, Golgi body, lysosome, vacuole).

1.2 DNA replication in prokaryotes:

1.2.1 Semi-conservative replication

1.2.2 Experiments of Stahl and Meselson

1.2.3 Leading strand and lagging strand DNA synthesis.

1.2.4 **DNA Transcription:**

1.2.4.1 mRNA, tRNA and rRNA transcription in prokaryotes (Initiation, elongation and termination).

1.2.4.2 Post transcriptional modifications of eukaryotic RNA primary transcripts.

1.2.5 **DNA Translation:**

1.2.5.1 Protein synthesis; properties of the genetic code

1.2.5.2 Amino acid activation, initiation, elongation and termination.

1.2.6 **Regulation of gene expression**:

1.2.6.1 Significance; the Lac operon system; End product inhibition.

1.2.7 **Types of gene mutation:**

1.2.7.1 Deletions, insertions, substitutions

1.2.7.2 Sickle cell anaemia as an example of a point mutation.

1.2.8 **Mutagens:**

1.2.8.1 Mutagenic effects

1.2.8.2 Chemical e.g. deamination and depurination

1.2.8.3 Physical e.g. dimerization

1.2.8.4 Biological e.g. mutation due to viral infection.

4.0 Practical Biology and Investigative Skills

TEACHING METHODS

1. Lectures and Tutorials
2. Practical/Laboratory
3. Demonstrations
4. Group discussions

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**50%**
1.1 2 Tests (theory)	20%
1.2 2 Assignments/Tutorial quizzes	5%
1.3 Laboratory work	15%
1.4 Practical/Lab test	10%

2.0 Final Examinations	**50%**
2.1 Theory	50%

PRESCRIBED READINGS:

1. Mary, J. Richard, F. et al. (2014). **Cambridge International AS and A Level Biology**. 4th ed. New York: Cambridge Press.

RECOMMENDED READINGS

1. Imran. P. Nivedita D. (2015). **A Text Book of Molecular Biology**. 1st ed. Pune: Vision Publishers

YEAR ONE SEMESTER TWO

Course Codes	Course Titles
P121	Introductory Physics II
M122	Mathematical Methods II
C123	Introductory Chemistry II
B124	Biological Sciences II

COURSE TITLE: INTRODUCTORY PHYSICS II
COURSE CODE: P121

INTRODUCTION

This course is a continuation from the first semester and is meant to build upon the foundation physics, for students to coherently comprehend subjects in higher Life Sciences' studies. Complex living organisms transport materials, sense their environment, process signals, and respond to changes using processes understood in terms of physical principles. This approach enables students to grasp how the earth functions in relation to energy interactions such as gravity, magnetic, electrical interactions, and therefore integration of mathematics, geology and physics helps to understand how the earth functions.

COURSE AIM:

The course aims at equipping students with fundamental knowledge and a sound understanding of physics together with practical, analytical and mathematical skills that enable them apply to manage environmental health parameters

COURSE OBJECTIVES:

1. Explain thermal properties of matter and their thermodynamics in physical processes
2. Elucidate the harmonic motion and the application of Hooke's Law.
3. Define magnetism and describe laws related electric magnetic induction.
4. Describe electric forces and fields and their applications in a real world situation 5. Demonstrate an understanding of different properties of light and their applications

.

COURSE LEARNING OUTCOMES

1. Apply quantitative reasoning and appropriate mathematical calculations in physics to describe or explain phenomena in the natural world
2. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated
3. Demonstrate knowledge of basic physical principles and their applications to the understanding of living systems
4. Demonstrate understanding of mechanics as applied to human and diagnostic systems

COURSE CONTENT

1.0 Thermal properties of matter

1.1 Heat and heat units
1.2 Thermal energy
1.3 Specific heat capacities
1.4 Heat of fusion and melting
1.5 Calorimetry
1.6 Thermal expansion
1.7 Heat conduction, convection, and radiation.

2.0 Thermodynamics:

2.1 Kelvin scale
2.2 State variables
2.3 First law
2.4 Work done by and on a gas
2.5 Specific heat of an ideal gas
2.6 Adiabatic, isothermal, and isobaric processes
2.7 Second law
2.8 Entropy
2.9 Carnot engine.

3.0 Harmonic motion:

3.1 Periodic motion

3.2 Hooke's law, spring; Harmonic motion; Sinusoidal motion; Simple pendulum; Forced vibrations.

4.0 Waves:

4.1 Description of a wave; Reflection of a wave; Standing waves; Wave resonance; Transverse and longitudinal waves; Compression waves.

5.0 Sound and Acoustic phenomena:

5.1 Sound waves; Speed of sound; Intensity and Intensity level; Response of the ear
5.2 Interference of sound waves; Beats; Doppler Effect.

16.0 Electric forces and fields:

6.1 Electric charge
6.2 Insulators and conductors
6.3 Electroscope
6.4 Conservation of Charges

6.5 Coulomb's law; Electric filed.

7.0 Electric potential:
7.1 Electric potential energy; Potential difference; Electron volt unit; Absolute potential
7.2 Capacitors; Dielectrics; Capacitors in combination.

8.0 Direct Currents:

8.1 Electric current; Ohm's law; Resistivity; Electric power; Kirchhoff's rules; Resistors in series and parallel; Circuit problems; Ammeters and voltmeters; emf of a battery.

9.0 Magnetism:
9.1 Magnetic field; Magnetic field of an electric current; Force on a current in a magnetic field
9.2 Forces on moving charges; Particle motion in a magnetic field; Forces between two currents; Ampere unit; Torque on a current loop; Motors and meters.

10.0 Electronic magnetic induction: 10.1Induced emf; Magnetic flux; Faraday's law;

Lenz's law; Motional emf; Transformers.

11.0 Properties of light:
11.1 Reflection; Plane, concave, and convex mirrors;

11.2 The mirror equation; Refraction; Snell's law; Total internal reflection;
11.3 Lenses; Thin lens formula; Ray diagrams; Combination of lenses.

12.0 Practical Physics and Investigative Skills

TEACHING METHODS
1. Lectures
2. Practical/Laboratory
3. Demonstrations
4. Group discussions
6. Tutorials

NOTIONAL HOURS: 150 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 **Continuous assessment**	**50%**
1.1 2 Tests (theory)	20%
1.2 2 Assignments/Tutorial quizzes	5%
1.3 Laboratory work	15%
1.4 Practical/Lab test	10%
2.0 Final Examinations	**50%**
2.1 Theory	50%

PRESCRIBED READINGS:

1. Rarmond, A, Emeritus, J, et al. (2019) Physics For Scientists and Engineers. 10th ed. UK: Cengage Learning.
2. DK, Jim Al-Khalili. (2020). **The Physics Book**. DK Publishers Portsmouth, England

RECOMMENDED READINGS

1. Meredithand, D.C. and Redish, E.F. (2013). **Re-inventing physics for life-sciences majors**. Phys. Today 66(7), 38

COURSE TITLE: MATHEMATICAL METHODS II
COURSE CODE: M122

INTRODUCTION

Mathematical calculations help students to reflect upon their findings and problem-solving processes. Students are encouraged to share their thinking with lecturers and peers and to examine different problem-solving strategies. Critical reflection in mathematics helps students gain insight into their strengths and weaknesses as learners and to appreciate the value of errors as powerful motivators to enhance learning and understanding.

COURSE AIM:

The course aims at equipping students with mathematical modes of thought and develops concepts from the following branches of mathematics, namely, algebra, geometry, vectors and matrices including calculus.

COURSE OBJECTIVES:

1. Correctly solve problems applying important concepts in binomial expansions, including vector analysis and understanding the principles of mathematical induction
2. Solve problems in differential and integral calculus, analysis of vectors and matrices including geometrical appreciation
3. Solve further complex numbers
4. Think logically, analytically, and abstractly
5. Communicate mathematics, both orally and in writing

COURSE LEARNING OUTCOMES

1. Develop mathematical curiosity and use inductive and deductive reasoning when solving Problems
2. Develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others
3. Develop a critical appreciation of the use of information and communication technology in mathematics
4. Use appropriate mathematical concepts and skills to analyse solve problems in both familiar and unfamiliar situations including those in real-life contexts

COURSE CONTENT

1.0 Binomial Expansions

1.1 Pascal's triangle; factorials; Binomial coefficients; Binomial formula for positive integral exponents; Binomial formula for rational exponents.

2.0 The Principle of Mathematical induction

3.0 Coordinate geometry

3.1 Distance between two points; division of a straight line into a ratio; equation of a straight line; parallel and perpendicular lines; distance between a point and a line; equation of a circle; tangent and normal lines to a circle.

4.0 Further Differential Calculus

4.1 Tangents and normal lines to a curve; increasing and decreasing functions; stationary points (critical points); point of inflexion; relative maximum and minimum; related rates; curve sketching and asymptotes of rational functions

5. **Integral Calculus**

5.1 Indefinite integrals: methods of integration; substitution, integration by parts, change of variable, partial fraction; definite integrals; applications to areas

6.0 Vectors and Matrices

6.1 Vectors: Definition; vector addition; vectors in 3 – dimension; dot product; vector (cross) product; applications to perpendicular and parallel vectors and areas.

6.2 Matrices: Sum; product; transpose; determinants; factorisation of determinants; inverse matrix; applications: Solutions of system of linear equations by inverse matrix method;

Cramer's rule

7.0 Further Complex Numbers

7.1 Complex numbers in Polar form: Modulus and argument; De-Moivre's theorem; roots of a complex number.

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Assessment and self-study: 5 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**50%**
1.1 2 Tests	40%
1.2 Tutorial quizzes	10%

2.0 Final Examinations	**50%**
2.1 Theory	50%

PRESCRIBED READINGS:

1. M. Liebeck (2015). **A Concise Introduction to Pure Mathematics**. 3rd ed. UK: Chapman and Hall/ CRC.
2. Gilderdale, A, Haese, S, et al. (2018). **Cambridge Additional Mathematics**. 2nd ed. UK: Haese Mathematics.

RECOMMENDED READINGS

1. Nicholson, S, Ransom, P, et al (2018). **Additional Math Student Book** 1st ed. UK. Collens Publisher.

COURSE TITLE: INTRODUCTORY CHEMISTRY II
COURSE CODE: M123

INTRODUCTION

The course is the second semester component of a general chemistry course that aims to prepare students for further studies that require a thorough foundation in Chemistry. It covers basic inorganic, analytical, organic and physical chemistry, and aims to impart basic experimental and study skills.

COURSE AIM

The course aims at providing the foundation of general chemistry in order to impart experimental skills to students in organic, analytical, organic and physical chemistry necessary to make scientific decisions that benefit mankind.

COURSE OBJECTIVES

1. Describe chemical equilibrium, apply LeChaterlier‘s principle, and apply concepts to solutions and buffers.
2. Describe intermolecular forces and sketch and interpret simple phase diagrams.
3. Elucidate general principles of solubility and colligate properties of solutions.
4. Solve problems in organic chemistry
5. Classify, name and write the structure of organic compounds and state functional groups.
6. Explain bonding and isomerism in alkanes, predict and write reaction of organic compounds.

COURSE LEARNING OUTCOMES

1. Demonstrate skills in handling simple equipment/glassware, in making observations, recording and analysis of data
2. Discuss factors influencing the rate of reaction, and apply the rate law, and Arrhenius equation.
3. Write a comprehensive report (including a critical evaluation of the results) about chemical experiments

COURSE CONTENT

1.0 **Chemical Kinetics**

1.1 Rate of reaction, average rate, instantaneous rate, initial rate,

1.2 Factors affecting rate – concentration, particle size, temperature, catalyst;

1.3 Rate laws, rate constant and its units;

1.3 Integrated rate law equations for zero order, first order and second order reaction; Half- life, linear relations of integrated rate equations,

1.4 Temperature dependence of rate constants and Arrhenius equation;

1.5 Activated complex theory (ACT) and Collision theory;

2.0 Chemical equilibrium

2.1 Homogenous equilibrium: Gas-phase equilibrium; equilibrium constants; Kc and KP relationships; relationship between equilibrium constant and Gibbs energy; Factors affecting chemical equilibrium; Le Chatelier Principle. Solubility and solubility products, common ion effect.

3.0 Acid-base equilibrium

3.1 Definition of acids and bases; strong and weak acids and bases; Equilibrium constants; pH and pOH of acids and bases; Hydrolysis of salts of weak acids and bases; Buffers; Indicators; Titration curves.

4.0 Phase equilibrium

4.1 One-component phase equilibrium- phases diagram of water and carbon dioxide; Claussius-Clapeyron equation.

5.0. Intermolecular forces:

5.1 van der Waal's forces, dipole-dipole interaction, hydrogen bonding; bonding and physical properties – vapour pressure, boiling point, melting point, solubility.

6.0 Solutions and their properties

6.1 Types of solutions: saturated, unsaturated, and supersaturated solutions; non-electrolytes and electrolytes; solubility of nonvolatile solutes, solution of volatile solute and solvents, solubility of gases in liquids - Henry's law.

6.2 The v'ant Hoff equation; vapour pressure of a solution with a volatile solvent and non-volatile solute (Raoults Law); vapour pressure of a solution of a volatile solute and volatile solvent; colligative properties: vapour-pressure lowering, boiling-point elevation, freezing point depression, and osmotic pressure.

7.0 Organic Chemistry

7.1 Organic chemistry, and why study organic chemistry?

7.2 Hybridization of carbon and bonding in organic compounds

7.3 Elemental composition and classification of organic compounds

8.0 Hydrocarbons: Molecular and structural formulae; Expanded (Lewis), condensed and line-bond (skeletal) presentations, nomenclature (IUPAC and trivial), classification of carbons and hydrogens, structural isomerism, physical properties of alkanes (acyclic and cyclic), alkenes (acyclic and cyclic) and alkynes

8.1 Aromatic hydrocarbons: Resonance, nomenclature (IUPAC and trivial), classification of carbons and physical properties

8.2 Functional groups in organic chemistry: Structure, nomenclature and priority (suffixes and prefixes) of halo alkanes, amino alkanes, nitro alkanes, alcohols, ethers, ketones, aldehydes, nitriles carboxylic acids, esters, and amides 8.3 The importance of Index of hydrogen deficiency (IHD)

8.4 Degree of Unsaturation (DU); its calculation and interpretation

8.5 Reactions: Definition of a reaction, Substitution and addition, radicals, carbocation's, electrophiles and nucleophiles and the curly arrows and half arrows for movement of electrons

8.6 Reactions of alkanes: Combustion of hydrocarbons and Halogenation of alkanes.

9.0 Practical Chemistry and Investigative Skills

TEACHING METHODS

1. Lectures
2. Practical/Laboratory
3. Demonstrations
4. Group discussions
6. Tutorials

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment 50%
1.1 2 Tests (theory) 20%
1.2 2 Assignments/Tutorial quizzes 5%
1.3 Laboratory work 15%
1.4 Practical/Lab test 10%

2.0 Final Examinations 50%
2.1 Theory 50%

PRESCRIBED READINGS

1. Steven. S, Susan. A (2013). **Zumdal Zumdal Chemistry**. 9th ed. UK. Cengage Learning Press
2. Karen. C (2017). **An Introduction to General, Organic, and Biological Chemistry**. 13th ed. Los Angles. Pearson publisher.

RECOMMENDED READINGS

1. Martin, S. (2012). **Principles of General Chemisry**. 3rd edition. New York, Mc Grow-Hill Press

COURSE TITLE: BIOLOGICAL SCIENCES II
COURSE CODE: B124

INTRODUCTION

The course provides foundation that introduces students to fundamental principles of genetics, animal biology including plant biology that highlights the diversity of life on earth and its relationship to the environment.

COURSE AIM:

The course aims at equipping students with knowledge and practical skills of understanding anatomical and physiological functions of plants and animals.

COURSE OBJECTIVES

1. State and explain biological facts, terms, principles and concepts.
2. Demonstrate an understanding of chromosomal theory of inheritance
3. Demonstrate an understanding of the tissues and organs and their functions in mammals
4. Describe the visible and anatomical structures of seed plants and their functions, and demonstrate an understanding of the basis of variation in structure.
5. Explain how biodiversity can be impacted by environmental factors
6. Describe the structure and function of plant systems.
7. Explain the structure-function relationships.

COURSE LEARNING OUTCOMES

1. Apply biological knowledge and principles in handling, assessing and evaluating non-numerical biological information
2. Use biological analysis to drawing conclusions and making inferences.
3. Demonstrate precision in practical techniques including accurate observation and recording.
4. Write a concise and coherent scientific report based on the biological analytical results

COURSE CONTENT

2.0 GENETICS:

2.1 Chromosomal theory of inheritance:

2.1.1 Discovery of chromosomes

2.1.2 Chromosomal structure (DNA, histones, nucleosomes)

2.1.3 2.1.3 Genes and alleles.

2.2 Cell division:

2.2.1 Cell cycle, mitosis and meiosis

2.2.2 Chiasma formation and chromosomal recombination.

2.3 Genetics:

2.3.1 Introduction to genetics: Definition and significance of genetics; key concepts in genetics: (e.g. phenotype, genotype, homozygote, heterozygote, dominance, incomplete dominance, codominance, recessive gene; P, F1 and F2 generations; test cross and back cross, etc.)

2.4 Mendelian Genetics:

2.4.1 Mendel's First and Second Laws;

2.4.2 Monohybrid cross, Dihybrid cross, Test cross and back cross

2.4.3 Use of the Punnet square; the Chi-squared test.

2.5 Post-Mendelian Genetics:

2.5.1 Multiple alleles, lethal genes, polygenic inheritance (continuous and discontinuous variation), gene linkage.

2.5.2 Gene interactions: Epistasis and modifications of Mendelian phenotypic ratios.

2.5.3 **Sex determination and sex-linkage**: Inheritance of sex and sex-linked traits; colour blindness and haemophilia as examples of X-linked diseases in humans; hormonal effects on sex expression

3.0 ANIMAL BIOLOGY

3.1 Tissue and Organs

3.1.1 The structure, function and physiology of mammals concerning mammalian tissues and organs

3.1.2 Integumentary structures, skeleton and muscles.

3.1.3 Nutrition; Organic and Inorganic nutrients including trace elements

3.1.4 Structure of mammalian teeth and their functions

3.1.5 Digestion, absorption, assimilation and egestion; utilization of absorbed amino acid, monosaccharides and lipids

3.1.6 Function of the mammalian liver

4.0 PLANT BIOLOGY

4.1 Plant biology and environmental factors

4.1.1 Cell structure and ultrastructure of eukaryote and prokaryote cells: cell specialization
4.1.2 The role of meiosis
4.1.3 Genotype and environmental influence
4.1.4 Stem cell research and implications
4.1.5 Biodiversity, adaptations and natural selection
4.1.6 Principles of taxonomy
4.1.7 Plant cell structure
4.1.8 Transport of water in plants
4.1.9 Uses of plant products

4.2 Environmental factors and Biological diversity

4.2.1Photosynthesis; energy transfer with ecosystems
4.2.2 Evidence of global warming
4.2.3 Evolution through natural selection and speciation
4.2.4 Nutrient recycling
4.2.5 DNA profiling and PCR
4.2.6 Structure of bacteria and viruses
4.2.7 Infectious diseases (eg AIDS and TB) and immunology

5.0 Practical Biology and Investigative Skills

TEACHING METHODS

1. Lectures
2. Practical/Laboratory
3. Demonstrations
4. Tutorials

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0	**Continuous assessment**	**50%**
1.1	2 Tests (theory)	20%
1.2	2 Assignments	5%
1.3	Laboratory work	15%

1.4 Practical/Lab test	10%
2.0 Final Examinations	**50%**
2.1 Theory	50%

PRESCRIBED READINGS:

1. Mary, J. Richard, F. et al. (2014). **Cambridge International AS and A Level Biology**. 4th ed. New York: Cambridge Press.

RECOMMENDED READINGS

1. Imran. P. Nivedita D. (2015). **A Text Book of Molecular Biology**. 1st ed. Pune: Vision Publishers

YEAR TWO SEMESTER ONE

Course Codes	Course Titles
EHS 211	Applied Human Physiology and Anatomy
EHS 212	Applied Microbiology, Virology and Parasitology
EHS 213	Food Chemistry and Nutrition
EHS 214	Environmental Science
EHS 215	Information Technology and Communication

COURSE TITLE: APPLIED HUMAN PHYSIOLOGY AND ANATOMY
COURSE CODE: EHS 211

INTRODUCTION

The course provides a background in fundamentals of human anatomy and an understanding of the fundamentals of cellular and systems physiology.

COURSE AIM

To equip students with knowledge and skills of the functions of human anatomy and physiology on different human systems

COURSE OBJECTIVES

1. Define key terms in physiology
2. Describe the structure and function of cells, including cellular metabolism and reproduction
3. Describe the structure and function of tissues and glands of various systems
4. Explain the skeleton system
5. Describe the muscular system
6. Explain blood circulatory system
7. Explain the lymphatic system
8. Describe the respiratory system
9. Describe the digestive system
10. Explain the excretory system (kidneys and skin) 11. Describe the reproductive system:
12. Describe the nervous system
13. Explain sense organs

COURSE LEARNING OUTCOMES

1. Identify anatomical structures on models, diagrams or the human body
2. Describe the physiological functions of the human body
3. Illustrate various types of body systems
4. Explain major components of human body systems
5. Relate the structure of the systems to their functions
6. Elucidate the significance of the circulatory system
7. Identify various organs of the human body
8. Illustrate anatomical parts of the various organs of the human body.
9. Illustrate the muscular system by identifying different types of muscles
10. Elucidate different types of joints
11. Discuss the physiology and mechanism of respiration factors affecting or controlling respiration
12. Relate the functions body systems to the nervous systems
13. Identify the sensory organs
14. Illustrate the human reproductive system
15. Apply practical knowledge on real or assimilated objects

COURSE CONTENT

1.0 Human Anatomy and Physiology

1.1 Introduction to anatomy and physiology

1.1.1 The cell

1.1.2 Levels of structural organization

1.2 **Integumentary system**

1.2.1 Skin

1.2.2 Hair

1.2.3 Glands

1.3 **Skeletal system**

1.3.1 Structure of the skeleton

1.3.2 Bone formation

1.3.3 Bone growth, Joints

1.4 **Muscular system**

1.4.1 Types and function

1.4.2 Skeletal muscle

1.4.3 Cardiac muscle

1.4.4 Smooth muscle

1.4.5 Movement muscle

1.5 **Nervous system**

1.5.1 Organization of the nervous system

1.5.2 Histology of the nervous system

1.5.3 Physiology of the nervous system

1.5.4 Central nervous system

1.6 **Special sense organs**

1.6.1 Eyes

1.6.2 Tongue

1.6.3 Nose 1.6.4 Ear

1.7 **Cardiovascular system**

1.7.1 Blood, Blood vessels

1.7.2 Blood reservoir

1.7.3 Structure of the heart

1.7.4 Conduction system of the heart

1.7.5 Cardiac cycle

1.7.6 Physiology of circulation

1.8 **Lymphatic system**
- 1.8.1 Lymph
- 1.8.2 Lymphatic vessels
- 1.8.3 Lymphatic tissues
- 1.8.4 Lymphatic circulation

1.9 **Respiratory system**
- 1.9.1 Upper and lower respiratory tract
- 1.9.2 Respiration
- 1.9.3 Control of respiration

1.10 **Digestive system**
- 1.10.1 Oesophagus and stomach
- 1.10.2 Small and large intestine

1.11 **Reproductive system**
- 1.11.1 Male reproductive systems
- 1.11.2 Female reproductive systems
- 1.11.3 Hormonal control of the reproductive system
- 1.11.4 Embryology

1.12 **Endocrine system**
- 1.12.1 Pituitary gland
- 1.12.2 Pineal gland
- 1.12.3 Parathyroid
- 1.12.4 Thyroid
- 1.12.5 Pancreas
- 1.12.6 Adrenals

1.13 **Urinary system**
- 1.13.1 Kidney
- 1.13.2 Bladder
- 1.13.3 Nephron
- 1.13.4 Urethra

TEACHING METHODS

1. Lectures
2. Group discussions
3. Practical
4. Demonstrations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment:	**40%**
1.1 2 Tests:	20%
1.2 2 Assignments:	10%
1.3 Practical	10%
2. Final Examinations:	**60%**
2.1 Theory:	40%
2.2 Practical:	20%

PRESCRIBED READINGS

1. Elaine, N.M. and Katia, N.H. (2015). **Anatomy and Physiology**. 10thEdition. London: Churchill Livingstone
2. Gerald, J.T. (2013). **Principle of anatomy and physiology. Atlas of skeletonse**t. 8thEdition. Washington: Saunders
3. Saladi K. (2014). **Anatomy and physiology**. 5thedition. New Delhi: Jaypee brothers.

RECOMMENDED READINGS

1. Frederic, A.M and Judil, N. (2014). **Fundamentals of Anatomy and Physiology**. 10th Edition. Washington: Saunders.
2. JayaranPanika, C. K. (2015). **Human physiology: An intergrated**, 3rd Edition. New Delhi: Jaypee Brothers.
3. Tortora, J. &Derrickson B. (2014). **Principles of anatomy and physiology**. 14thedition: John Wiley and Sons inc.

COURSE TITLE: APLLIED MICROBIOLOGY, VIROLOGY AND PARASITOLOGY
COURSE CODE: EHS 212

INTRODUCTION

The course provides the students with basic knowledge and understanding of various organisms and their effects on the human body and the environment.

COURSE AIM

To enable students acquire knowledge, skills and attitudes in microbiology, parasitology, immunology and pathology.

COURSE OBJECTIVES:

1. Define key terms and concepts
2. Describe the different types of microorganisms of public health significance
3. Explain methods of infection prevention
4. Explain the different classification of parasites
5. List the various parasites that causes human disease
6. Describe the pathogenesis of parasitic diseases
7. Discuss the Host-Agent response in clinical disease manifestation in humans.
8. Describe the factors that influence the geographical distribution of parasites
9. Identify common parasites affecting humans
10. Describe common Pathological disorders, and their management.

COURSE LEARNING OUTCOMES

1. Classify the different types of microorganisms
2. Handle laboratory equipment and specimen safely.
3. Apply the knowledge acquired for use of Microbiology in Public health
4. Explain the concepts in general pathology
5. Demonstrate an understanding of pathological processes of Communicable and Non-communicable diseases.
6. Demonstrate knowledge on infection prevention
7. Collect water samples for microbial investigation and take appropriate action
8. Collect specimen for parasitic investigation and take appropriate action
9. Explain the diagnostic procedures in pathology
10. Discuss immune responses to parasitic infections
11. Conduct microscopic investigations for identification of various parasitic organisms
12. Illustrate the structure of bacteria and its growth
13. Classify pathological disorders
14. Discuss management of pathological disorders

COURSE CONTENT

1.0 Immunology

1.1 Innate immunity

1.1.1 Non-specific Immunity, physical, chemical and biological

1.1.2 Acute inflammatory reaction

1.1.3 Leukocytes, Complementary system

1.2 Cells of adaptive immunity

1.2.1 B-cells and their functions

1.2.2 1T- cells and their functions

1.3 The immune system in health and disease

1.3.1 Interaction between innate and adaptive immunity

1.3.2 Escape strategies

1.4 Disorders of immunity

1.4 1 Hypersensitivity reactions

1.4.2 Auto-immune diseases, Immunodeficiency

1.4.3 Tumour immunology

1.5 Microbiology

1.5.1 Microbial physiology

- Structure of bacteria
- Classification of bacteria
- Bacterial growth
- Normal microbial flora
- Bacteria of medical importance

1.6 Bacterial pathogenesis and host resistance to infection

1.6.1 Basis of bacterial pathogenicity

1.6.2 Host resistance to infection

1.6.3 Principles of serological diagnosis

1.7 Use of microbiology in public health

1.7.1 Microbiology of water, food and air

1.8 Technical methods in microbiology, related to water and airborne diseases

1.8.1 Sterilization and disinfection

1.9 Medical parasitology

1.9.1 Pathogenesis of parasitic diseases

- Etiology
- Disease processes due to parasites
- Immunity and immune responses to parasitic infections.
- Parasite evasion of the immune system

1.10 Protozoology

1.10.1. Haemoprotozoa (plasmodium and trypanosomes)
1.10.2 Intestinal amoebae, Intestinal flagellates

1.11. Helminthology

1.11.1 Nematodes
1.11.2 Trematodes
1.11.3 Cestodes

1.12 Virology

1.12.1 Classification of viruses
1.12.2 Morphology and structure
1.12.3 Pathogenicity of viruses
1.12.4 Viruses and Human tumours

1.13 Common viruses:

1.13.1 Enterovirus infections
1.13.2 Measles
1.13.3 Ebola
1.13.4 Coronavirus
1.13.5 Acute Viral Respiratory diseases
1.13.6 Arthropod viral diseases (Dengue, Yellow fever, and West Nile fever)
1.13.7 Retrovirus
1.13.8 Immunisations and virus.

1.14 Mycology

1.14.1 Mycoses physiology

1.14.1.1 Structure of fungi
1.14..2 **Pathogenesis**
1.14.1.3 **Dematomycoses** Tinea
pedis

- Tinea cruris
- Tinea corporis
- Tinea capitis

1.14.2 Systematic mycoses

1.14.2.1 Cryptococus
1.14.2.2 Candidacies
1.14.2.3 Mycetoma aspergillus

1.14.3 Subcutaneous mycoses

TEACHING METHODS

1. Lectures
2. Group discussions
3. Practical
4. Demonstrations
5. Field visits

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Practical/Lab: 2 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment:	**40%**
1.1 2 Tests:	20%
1.2 2 Assignments:	10%
1.2.3 Practical	10%
2. Final Examinations:	**60%**
2.1 Theory:	40%
2.2 Practical:	20%

PRESCRIBED READINGS

1. Ramnik, S. (2012). **Medical Laboratory Technology**. 5rd edition. New Delhi: Jaypee brothers.

RECOMMENDED READINGS

1. Jawetz, E. Melnick, J. A. (2010). **Review of Medical Microbiology.** 16th Edition. Lange ISBN: 0-87041-053-9.
2. Jayaran-Panika .C. K. (2011). **Text Book of Medical Parasitology**. 4rd edition, New Delhi: Jaypee brothers.

COURSE TITLE: FOOD CHEMISTRY AND NUTRITION
COURSE CODE: EHS 213

INTRODUCTION

The course provides the students with basic knowledge and understanding of various nutritional components, nutritional disorders and how they are resolved in the community.

COURSE AIM:

To equip students with knowledge, skills and attitude to prevent and manage common nutrition related conditions in the community.

COURSE OBJECTIVES:

1. Define key terms in food chemistry and nutrition
3. Explain the importance of nutrients to human health
7. Use the food groups to formulate mixed diets for different age groups
8. Utilise the food pyramid to plan diets for different age groups
9. Conduct nutrition education on prevention of nutritional disorders

COURSELEARNING OUTCOMES:

1. Draw the basic structures of the main nutrients
2. Provide information on the functions of various nutrients in the human body.
3. Outline the basic metabolism of the main nutrients
4. List the sources of various nutrients
5. Explain the common nutritional disorders
6. Relate a mixed diet to the prevention of nutritional disorders
7. Use the food groups to formulate mixed diets for different age groups
8. Utilise the food pyramid to plan diets for different age groups
9. Employ the daily dietary allowances to formulate a mixed diet for various age groups
10. Conduct nutrition education on prevention of nutritional disorders
11. Collect nutritional status data using common appropriate tools

COURSE CONTENT

1.0 Introduction to Food Chemistry and Nutrition

1.1 Definition of common terms: food; food chemistry, and nutrition;
1.2 World food status: statistical records;
1.3 Nutrition status in Zambia: statistical records.

2.0 Carbohydrates

2.1 Introduction
2.2 Classification and Source
2.3 General structure and functions
2.4 Digestion and absorption
2.5 Basic Metabolism of carbohydrates
2.5.1 Dietary allowance
2.5.2 Glycolysis
2.5.3 Gluconeogenesis
2.5.4 Glycogenolysis
2.5.5 Glycogenesis; Krebs cycle (citric acid cycle);
2.6 Disorders of carbohydrate metabolism
2.6.1 Diabetes mellitus
2.6.2 Lactose intolerance
2.6.3 Obesity
2.6.4 Deficiency Disorders of Carbohydrates

3.0 Proteins

3.1 Introduction
3.2 General classification and Sources
3.3 Biochemical Classification
3.4 Structure and Functions
3.5 Digestion and absorption
3.6 Basic Metabolism of Proteins
3.7 Dietary allowances
3.8 Relationship with carbohydrates metabolism
3.8 Disorders and Deficiency of Proteins
3.10 Kwashiorkor
3.11 Integrated Management of Acute Malnutrition

4. **Lipids**

4.1 Introduction
4.2 General Classification and Sources
4.3 Structure and Functions
4.4 Digestion and absorption
4.5 Metabolism and Dietary allowances

4.5.1 Linkage between Carbohydrates, Proteins, and Lipids

4.6 Common disorders associated with Lipid;

4.6.1 Coronary heart disease

4.6.2 Hypercholesterolemia.

5.0 Vitamins

5.1 Introduction

5.2 General Classification and Sources

5.3 Properties and Functions

5.4 Absorption

5.5 Storage

5.6 Dietary Allowances

5.7 Deficiency disorders

5.8 Vitamin Supplementation program

6.0 Minerals

6.1 Introduction

6.2 General classification of minerals into major and trace minerals

6.3 Functions, Absorption, and Dietary Allowances

6.4 Common disorders

6.5 Mineral Supplementation program

6.6 Water

7.0 Approaches to Mixed Diets:

7.1 Introduction

7.2 Food exchange

7.3 Food grouping

7.4 Food pyramid; and

7.5 Daily Dietary Allowances

8.0 Nutrition in Life Cycle:

8.1 Introduction

8.2 1000 critical days

8.3 Infant and Young Child Feeding

8.4 Option B-plus/PMTCT guidelines

8.5 School Age

8.6 Adolescents; and

8.7 Geriatrics

9.0 Community Nutrition

9.1 Introduction

9.2 Nutritional Assessment

9.3 Nutritional Surveillance

9.4 Nutrition and HIV/ Cancers

10.0 Skill Development
10.1 Cookery Demonstrations
10.2 Gardening

TEACHING MATERIALS / EQUIPMENT
1. Standing scales
2. Salter scales
3. Under five cards
4. Mid Upper Arm circumference strips
5. Infant and young child feeding teaching manuals
6. Baby Scale (newly born babies)

TEACHING METHODS
1. Lectures
2. Group discussions
4. Demonstrations
5. Field visits

NOTIONAL HOURS: 80 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Practical/Lab: 1 hour session per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS
1. Continuous assessment: 40%

1.1 2 Tests:	20%
1.2 2 Assignments:	10%
1.3 Practical	10%

2. Final Examinations:	**60%**
2.1 Theory:	40%
2.2 Practical	20%

PRESCRIBED READINGS
1. Mahan, M.S K. (2011). Krause's **Food and Nutrition Care Process** 14th edition, Amazon
2. Ross, A. C and Caballero, B.M.D. (2012). **Modern Nutrition in Health and Disease**.
3. Whitney, N.E and Rolfes, R.S. (2012). **Understanding Nutrition.** Amazon

RECOMMENDED READINGS

1. Escott, S and Stump, M.A. (2011). **Nutrition and Diagnosis Related Care,** Amazon
2. Fada, L.D.N and Pronsky M. Z. (2012). Food Medical Interactions Spinal Bound
3. Marie, B.A and Hollen H. D. (2012). **Community Nutrition in Action**, 6th edition Amazon

COURSE TITLE: ENVIRONMENTAL SCIENCE
COURSE CODE: EHS 214

INTRODUCTION

The course is designed to equip students with knowledge in environmental science. It will provide an opportunity to students to comprehend the environmental crisis, ecology, ecosystems, resource depletion, population explosion and pollution.

COURSE AIM:

To enable students acquire knowledge and skills in comprehending environmental systems/ecosystems and interactions among physical, chemical and biological components related to the environment and the impact on the biodiversity and sustainability from local and global development

COURSE OBJECTIVES:

1. Define of Environmental Science and Ecology
2. Describe principles of ecology and ecosystems
3. Elucidate the meaning of carrying capacity of the environment
3. Explain the effects of population explosion on the environment and human health
4. Explain the population, resource depletion and pollution (PRP) model
5. Describe environmental and human health problems arising from resource depletion.
6. Explain the effects of pollution on the environment and human health

COURSELEARNING OUTCOMES

1. Analyze the environmental crisis with aid of a population, resource depletion and pollution (PRP) model
2. Apply the principles of environmental science to solve environmental problems
3. Elucidate environmental problems/issues
4. Analyze the scope of ecology and ecosystems
6. Describe population growth and its impact on the environment
7. Explain resource depletion
8. Describe pollution

COURSE CONTENT

1.0 Introduction to Environmental Science

1.1 Definitions of environmental science and ecology

1.2 Outline of environmental crisis: Over population, resource depletion and pollution

1.3 Scope and general principles of ecology

1.4 Ecosystem concept, biotic communities and ecological niches

1.5 Trophic structure: Food webs, trophic levels and ecological pyramids

1.6 Biogeochemical cycles, energy flow, biological production and productivity of communities

1.7 Plant and animal adaptation to the environment

1.8 Ecosystem development and evolution

1.9 Succession, diversity and stability of communities

2.0 Human impact on ecosystems

2.1 Restoration ecology, conservation and conservation policies

2.2 Environmental ethics, attitudes towards nature and sustainable society

2.3 Economics and the environment: Relationship between economic values and their environmental impact

2.4 National responsibilities: The role of government and other administrations and agencies in environmental protection

3.0 Environmental education:

3.1 Definition

3.2 Scope and role of environmental education in environmental mismanagement

TEACHING METHODS

1. Lectures
3. Demonstrations
4. Group discussions
5. Tutorials

NOTIONAL HOURS: 100 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 2 hours session per week
4. Seminar: 1 hour per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 Continuous assessment 40%

1.1 2 Tests 30%

1.2 2 Assignments 10%

1.0 Final Examinations	**60%**
1.1 Theory	60%

PRESCRIBED READINGS:

1. Chiras, D. D. (2013)**. Environmental Science**. New York: Jones Bartlett Leraning.
2. Wright, R.T and Boorse, D.F. (2011). **Environmental Science: Toward a Sustainable Future**. Boston: Pearson Education

RECOMMENDED READINGS

1. Bassett W.H. (2004). **Clay's Handbook of Environmental Health.** London: Spon Press.
2. Cunningham, W.P., and Cunningham, M.A. (2011). **Principles of Environmental Science: Inquiry and Applications**. New York: McGraw-Hill.
3. Enger, E.D., & Smith, B.S. (2010). **Environmental Science: A Study of Interrelationships**. New York: McGraw-Hill.

COURSE TITLE: INFORMATION TECHNOLOGY AND COMMUNICATION SKILLS
COURSE CODE: ITC 215

INTRODUCTION
This course is designed to help students understand the social conditions that affect psychological wellbeing and to describe the process linking the social conditions to their psychological effects. The course also assists the students to develop a framework for understanding the different psychological approaches as they apply to environmental health.

COURSE AIM
TO equip students with knowledge and skills in basic computer system, communication and health management information system

COURSE OBJECTIVES
1. Describe Information Technology
2. Define hardware and software of the computer system
3. Describe communication.
4. Describe management information system
5. Explain academic writing

COURSE LEARNING OUTCOMES
1. Operate the computer system
2. Operate windows operating packages
3. Browse the Internet
4. Send and receive e-mails
5. Utilize electronic media in environmental practices
6. Manage data from health institutions using electronic media
7. Elucidate types of communication
8. Illustrate methods of communication
9. Illustrate communication process
10. Explain group dynamics
11. Cite authority in the text
12. Provide references in a prescribed form

COURSE CONTENT

UNIT ONE: INFORMATION TECHNOLOGY

1.1 **Introduction to basic computers**

- 1.1.1 Definition
- 1.1.2 Characteristics of Computers
- 1.1.3 Basic Applications of Computer
- 1.1.4 Windows Operating System

1.2 **Hardware and software**

- 1.2.1 Definition of Hardware
- 1.2.2 Definition of Software

1.3 **Hardware Components of Computer System**

- 1.3.1 Input Devices
- 1.3.2 Output Devices
- 1.3.3 Storage Devices
- 1.3.4 Central Processing Unit
- 1.3.5 Communication Devices

1.4 **Types of software**

- 1.4.1 Operating Systems
- 1.4.2 Application Software
- 1.4.3 Generalized Application Software
- 1.4.4 Specialized Application Software
- 1.4.5 Utility Software

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1.5 **Software packages for statistical data analysis**

- 1.5.1 SPSS (Statistical Package for Social Sciences)
- 1.5.2 NVivo
- 1.5.3 R (R Foundation for Statistical Computing)
- 1.5.4 MS Excel (Microsoft Excel)
- 1.5.5 SAS (Statistical Analysis Software)
- 1.5.6 Epi Info. (Epidemiological Information)

1.6 **Other Computer Packages:**

- 1.6.1 Microsoft Office
- 1.6.2 Spread Sheets
- 1.6.3 Power Point
- 1.6.4 Microsoft Access
- 1.6.5 QuickBooks
- 1.6.6 Web and Social skills
- 1.6.7 Graphic and Writing Skills

1.7 **Internet and E-mail:**

1.7.1 Concept of internet;
1.7.2 Browsing and e-mail;
1.7.3 Logging on;
1.7.4 Send and receive email; and
1.7.5 Sending attachment.

UNIT TWO: COMMUNICATION SKILLS

2.1 Introduction to communication skills

2.1.1 Definition of communication
2.1.2 Types of communication
2.1.3 Elements of communication (message, sender and receiver)
2.1.4 Advantages of good communication
2.1.5 Factors that Promote communication
2.1.6 Factors that hinder communication
2.1.7 Effective communication

2.2 Functions of communication:

2.2.1 Entertainment; Information; Education;
2.2.2 Persuasion/mobilization; and
2.2.3 Development (social, political, economic).

2.3 Group dynamics

2.3.1 Group dynamics in communication; and learning process.

2.4 Academic writing:

2.1.1 Essay Writing;
2.1.2 Citations;
2.1.3 Referencing

2.4 Examination skills

2.4.1 Preparation for examinations
2.4.2 Understanding active words used in examination questions

2.5 Plagiarism

2.5.1 Definition of plagiarism
2.5.2 Types of plagiarism: direct plagiarism, self-plagiarism, mosaic plagiarism; accidental plagiarism
2.5.3 Consequences of committing plagiarism by:

- Students
- professionals

- academics and researchers

2.5.4 Legal consequences of committing plagiarism

2.5.5 Tips for avoiding plagiarism

TEACHING METHODS

1. Lectures
2. Practical
3. Demonstrations

NOTIONAL HOURS: 120 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Laboratory work: 2 hours session per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment:	**40 %**
1.1 2 Tests:	20%
1.2 2 Assignments:	10%
1.3 Computer lab work	10%
2. Final Examinations:	**60%**
1.1 Theory:	40%
1.2 Practical	20%

PRESCRIBED READINGS

1. Guffey, M. E. (2007). **Essentials of Business Communication**. 7th edition, Thomson Southwestern.
2. Hybels, S. & Weaver, R. (2004). **Communicating Effectively**. 7th Ed. Boston. McGraw Hill
3. Norton, P. (2002). **Introduction to Computers**. 5th Edition, Glencoe/McGraw-Hill

RECOMMENDED READINGS

1. Cottrell, S. (2001). **Teaching Study Skills and Supporting Learning**. Hampshire: Palgrave Publisher,.
2. Epsten, R. L. (2001). **Critical Thinking**. Victoria: Wadsworth Publisher
3. Feldman, R. S. (2000). **Power Learning: Strategies for Success in College and Life.** Boston: McGraw-Hill.

YEAR TWO SEMESTER TWO

Course Codes	Course Titles
EHS 221	Introduction to Environmental Health
EHS 222	Sanitation and Hygiene
EHS 223	Water Supply
EHS 224	Solid Waste and Health Care Management
EHS 225	Medical Entomology

COURSE TITLE: INTRODUCTION TO ENVIRONMENTAL HEALTH
COURSE CODE: EHS 221

INTRODUCTION

The course is designed to provide the students with knowledge and understanding the role of environmental health within the wider concept of public health. The course will also help students to understand how the environment influences human health and disease and be able to execute those services which implement environmental health policies through monitoring and control activities.

COURSE AIM:

To equip students with knowledge and skills in the management of the environment to ensure ecological balances essential to long-term human health and environmental quality, whether in the natural or man-made environment

COURSE OBJECTIVES:

1. Define key terms
2. Elucidate the core functions of environmental health
3. Explain the essential services of environmental within the overall health care system
4. Describe the factors influencing health service utilization
5. Explain the significance of public health assessment and the key areas of assessment
6. Explain the role of community diagnosis in the promotion of environmental health

COURSE LEARNING OUTCOMES

1. Apply principles of environmental health in the implementation of programmes and projects
2. Implement environmental health services in line with legal and institutional framework in Zambia
3. Conduct public health assessment to ascertain the needs of communities aimed at safeguarding the health of the public
4. Conduct community diagnosis appropriately
5. Implement health promotion activities aimed at creating health-supportive environments
6. Analyse public health assessment and community diagnosis' results to better livelihoods of the public

COURSE CONTENT

1.0 The concept of Public Health

1.1 Introduction to Environmental Health

1.1.1 Defining Public health, Environmental Health, Sanitation of the environment and good health.

1.1.2 Landmarks in the evolution of public health and environmental health

1.1.3 Vision, mission and values of environmental health

1.1.4 Pillars and core functions of Environmental health

1.1.5 Essential services of Environmental health

1.2 Pillars of Public Health

1.2.1 Disease prevention and control

1.2.2 Health promotion

1.2.3 Reproductive and child health

1.2.4 Health information and surveillance

1.2.5 Decentralisation of programmes

1.3 Public health administrative systems in Zambia

2.0 Society and health

2.1 Definitions and concepts

2.2 Factors influencing health service utilization

2.3 Provision of health care

2.4 Components of health care system in **Z**ambia's health reforms.

3.0 Public health assessment

3.1 Introduction

3.2 Assessing health status

3.3 Assessing health needs

3.4 Assessing health impacts on a population

4.0 Concept of community diagnosis.

4.1 Definition of a community

4.2 Definition of community diagnosis

4.3 Process of Community diagnosis

5.0 Sanitary Community diagnosis:

5.1 Determinants of sanitation in a community

5.2 Diagnosis of a community (preferably a village or high density residential area) in relation to water supply, sanitation, food hygiene, environmental and community hygiene
5.3 Practical sanitary community diagnosis

TEACHING METHODS
1. Lectures
3. Demonstrations
4. Group discussions

NOTIONAL HOURS: 80 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS:

1. Bassett W.H. (2004). **Clay's Handbook of Environmental Health.** London: Spon Press.
2. Koren, H., Bisesi, M. (2003). **Handbook of Environmental Health: Biological, Chemical and Physical agents of Environmentally Related Disease**. Fourth Edition, Vol. 1. New York: Lewis Publishers

RECOMMENDED READINGS

1. Afubwa, S,O., and Mwanthi, A.M. (2014) **Environmental Health and Occupational Health and Safety.** Nairobi: Acrodile Publishing Ltd

2. Stewart, J. (2001). **Environmental Health and Hosing: Clay's Library of Health and the Environment.** Volume 1. London: Spon Press.

3. Fumkin, H. (2010). **Environmental Health: From Global to Local.** Second edition. San Francisco: John Wiley and Sons Ltd.

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COURSE TITLE: SANITATION AND HYGIENE
COURSE CODE: EHS 222

INTRODUCTION

The course is designed to provide students with knowledge and skills in the management of sanitation in communities under their jurisdiction. The course will also highlight the techniques of managing hygiene education programmes at community level including the enforcement of laws related to sanitation.

COURSE AIM

To equip students with the knowledge and skills in sanitation and hygiene education approaches.

COURSE OBJECTIVES:

1. Define key concepts used in sanitation
2. Describe improved sanitation facilities
3. Elucidate various hygiene education methods you can recommend at community level
4. Describe the design and construction details of improved sanitation technologies
5. Explain strategies of faecal sludge management
6. Describe hygiene promotion strategies at community level

COURSE LEARNING OUTCOMES:

1. Apply concepts of sanitation during programme implementation
2. Identify appropriate preventive measures against faecal-oral diseases
3. State legal and institutional framework for sanitation in Zambia
4. Enforce laws related to sanitation
5. Analyze various sanitation technologies
6. Illustrate faecal – oral route of transmission
7. Recommend appropriate sanitation technologies to households
8. Advise appropriate sanitation options during an emergency
7. Demonstrate the construction of sanitation technologies
8. Recommend appropriate methods of faecal sludge management
9. Conduct hygiene education at community level

COURSE CONTENT

1.0 **Introduction to Sanitation**

1.1 Definition of key concepts in sanitation: sanitation, excreta, black water, greywater and brown water.

1.2 Reasons why human excreta should be properly managed.

1.3 Transmission of faecal-oral diseases (F-diagram)

1.4 Preventive measures against faecal-oral diseases

1.5 Legal and institutional framework for sanitation in Zambia.

2.0 **Siting and Construction of Improved Sanitation Facilities**

2.1 Definition of "improved" sanitation facilities

2.2 Flush toilet

2.3 Pour-flush toilet

2.4 Siting and construction of ventilated improved pit (VIP) latrine

2.5 Siting and construction of pit latrine with slab

2.6 Siting and construction of composting toilet

2.7 Design, siting and construction of a septic tank and soakaway

3.0 **Faecal Sludge Management**

3.1 Define faecal sludge management

3.2 Problems and challenges in faecal sludge management

3.3 Main options for pit emptying and faecal sludge transport: manual emptying; and mechanical emptying.

3.4 Options for faecal sludge management: sludge drying beds; composting with organic solid waste; and anaerobic digestion with biogas use

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4.0 Introduction to Wastewater Management

4.1 Definition of key concepts: wastewater, sewage, storm water and municipal wastewater.

4.2 Impacts of improperly disposed-off wastewater on human health and the environment

4.3 Legal and institutional framework for wastewater management in Zambia, global policies, strategies and statutes

5.0 Sanitary Fitments

5.1 Defining a sanitary fitment as per Public Health (Drainage and Latrine) Regulations

5.2 Soil water fitments; water closets, slop-hoppers, urinals, and urinettes.

5.3 Waste water fitments; baths, lavatory basins, sinks and housemaids' sinks. 5.4 Design and construction of sanitary fitments

6.0 Wastewater Drainage Construction

6.1 Defining a drainage system as per Public Health (Drainage and Latrine) Regulations 6.2 Types of drainage systems: combined drainage system; and separate drainage system.

6.3 Principles of sound drainage construction

6.4 Access to drainage system; man-holes and inspection chambers

6.5 Traps: waste water trap; soil water trap; gully trap; and intercepting trap.

6.6 Inspection and testing of drainage systems: water test; coloured water test; air pressure test, smoke test; and ball test.

6.7 Regulations on drainages in Zambia - Public Health (Drainage and Latrine) Regulations

7.0 Wastewater Quality Parameters

7.1 Define wastewater quality parameter

7.2 Chemicals parameters (BOD, COD, DO, nitrogen, phosphorus, pH)

7.3 Physical parameters (turbidity, colour, total dissolved solids, total suspended solids, settleable matter).

7.4 Microbiological parameters (E-coli, thermotolerant coliforms and total coliforms).

8.0 Waste Stabilization Ponds

8.1 Siting of waste stabilization ponds

8.2 Design of waste stabilization ponds

8.3 Construction and operation of waste stabilization ponds: anaerobic ponds; facultative ponds; and maturation ponds.

9. 0 Conventional Wastewater Treatment

9.1 Siting of conventional treatment plant

9.2 Stages in conventional wastewater treatment:

9.2.1 Preliminary treatment (screening, comminution, grit chamber and skimming);

9.2.1 Primary sedimentation;

9.2.2 Biological treatment: trickling filters; activated sludge system

9.2.3 Secondary sedimentation;

9.2.4 Tertiary treatment;

9.2.5 Sludge treatment and disposal

10. Wastewater/Effluent Quality Monitoring

10.1 Objectives of wastewater/effluent quality monitoring

10.2 Step 1: Develop a wastewater/effluent quality monitoring plan

10.3 Step 2: Prepare for sampling

10.4 Step 3: Collect samples for laboratory analysis

10.5 Step 4: Label and transport samples
10.6 Step 5: Laboratory analysis
10.7 Step 6: Review results and report

11.0 Wastewater Use in Agriculture
11.1 Driving forces to increased use of wastewater in agriculture
11.2 Public health risks associated with the use of wastewater in agriculture
11.3 Cost-effective strategies for controlling negative public health impacts of wastewater use in agriculture
11.4 Wastewater quality monitoring for wastewater meant for use in agriculture:
11.5 World Health Organisation (WHO) guidelines for quality of wastewater meant for use in agriculture

12.0 Hygiene Education
12.1 Scope of hygiene education
12.2 Hygiene educational methods
12.2.1 Participatory Hygiene and Sanitation Transformation (PHAST) methodology:
12.2.2 Community Led Total Sanitation (CLTS) methodology:

TEACHING METHODS
1. Lectures
2. Practical
3. Field visits
4. Group discussions

NOTIONAL HOURS: 120 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 3 hours per week
4. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Kamal, K. (2008). **Handbook on community-led total sanitation.** London: Plan United Kingdom
2. WHO (2000). **Participatory hygiene and sanitation transformation step by step activities**. Geneva: WHO Press.

RECOMMENDED READINGS

1. IWA Publishing (2014). **Faecal sludge management: systems approach for implementation and operation**. London: IWA Publishing.
2. WHO (2013). **Technical notes on drinking-water, sanitation and hygiene in emergencies**. Loughborough: WEDC.
3. UNICEF (2014). **School-Led Total Sanitation: School Facilitator Training Guide.** UNICEF press

COURSE TITLE: WATER SUPPLY

COURSE CODE: EHS 223

INTRODUCTION

The course will enable the students to demonstrate requisite knowledge and skills in the management of rural and urban water supply in Zambia.

COURSE AIM

To enable students demonstrate the knowledge, skills and attitudes in rural and urban water supply in Zambia.

COURSE OBJECTIVES

1. Explain the key concepts used in water supply.
2. Describe the various sources of drinking water
3. Categorise the three types of drinking water quality parameters.
4. Describe measures for protection of rural water supply sources
5. Describe the various stages of a conventional water treatment plant
6. Elucidate household water treatment and safe storage methods

COURSE LEARNING OUTCOMES

1. Describe the concepts used in water supply.
2. Categorise diseases associated with water in for categories
3. Describe five quantitative service level indicators for water supply
4. Interpret the legal and institutional frameworks for water supply in Zambia
5. Explain the hydrological cycle
6. Identify various water supply sources and technologies.
7. Categorise water supply technologies
8. Recommend appropriate measures for protection of rural water supply sources.
9. Explain the three types of drinking water quality parameters.
10. Describe the various stages of a conventional water treatment plant
11. Explain three common types of water distribution systems
12. Evaluate methods of supplying water
13. Describe measures you can take to prevent contamination of water distribution systems
14. Demonstrate the knowledge of household water treatment methods
15. Explain the importance of safe storage
16. Conduct sanitary inspections of water sources to establish their suitability for use

COURSE CONTENT

1.0 Introduction to Water Supply

1.1 Definition of concepts used in water supply; water, supply, and water supply.

1.2 Classification of diseases association with water: water-borne diseases; water based diseases; water related diseases; and water washed diseases.

1.3 Qualitative service level indicators: quality; quantity; continuity; accessibility; acceptability; and affordability.

1.4 Legal and institutional framework for water supply in Zambia; International statutes and policies.

2.0 Sources of Water

2.1 Hydrological cycle

2.2 Sources of water: groundwater; surface water; and precipitation (rainfall, glaciers, snow).

2.3 Categories of water technologies.

2.3.1 Unimproved water sources (unprotected dug well; unprotected spring; cart with small tank or drum provided by water vendor; tanker truck provision of water; surface water; and bottled water).

2.3.2 Improved water sources (piped water into dwelling, yard or plot**,** public tap or standpipe**;** kiosks, tube well or borehole**;** protected dug well**;** protected spring**;** and rainwater collection).

3.0 Protection of Rural Water Supply Sources

3.1 Hand dug wells with windlass

3.2 Boreholes with a hand pump

3.3 Springs

3.4 Rain water harvesting

4.0 Conventional Water Treatment and Distribution

4.1 Significance of water treatment

4.2 Sitting of water treatment plants

4.3 Water treatment units

4.3.1 Water intake structures

4.3.2 Preliminary treatment

4.3.3 Coagulation and flocculation

4.3.4 Sedimentation

4.3.5 Filtration

4.3.6 Disinfection

4.3.7 Clear water well

4.4 Water distribution
4.5 Types of water distribution systems
4.5.1 Gravity system,
4.5.2 Pumping system
4.5.3 Mixed gravity and pumping system

4.6 Systems of supplying water
4.6.1 Constant supply
4.6.2 Intermittent supply

5.0 Household Water Treatment and Safe Storage Methods
5.1 Introduction
5.2 Household water treatment methods: boiling; point of use chlorination; biosand\ filtration; solar disinfection; three pot system; cloth filtration; and ceramic filtration
5.3 Safe storage

6.0 Water Quality Surveillance
6.1 Define water quality monitoring and drinking-water quality surveillance
6.2 Objectives of drinking-water quality surveillance
6.3 Types of approaches to drinking-water quality surveillance
6.3.1 Audit based approach
6.3.2 Direct assessment approach
6.4 Legal and institutional framework for drinking-water quality surveillance in Zambia

7.0 Drinking-Water Quality Parameters
7.1 Selection of drinking-water quality parameters to be included in a surveillance programme. 7.2 Microbiological parameters: E-coli, thermotolerant coliforms (faecal coliforms) and total coliforms.
7.3 Physical parameters: turbidity, taste, odour, and colour.
7.4 Chemicals parameters: nitrate, arsenic, lead, fluoride, iron, manganese, aluminium, pH, residue chlorine, copper and pesticides.

8.0 Drinking-Water Sampling
8.1 Plan for sampling
8.2 Sampling frequency criteria (type of sample, season, disease prevalence, risk of contamination, and availability of resources)
8.3 Sampling procedures for various drinking water sources (wells, taps, and borehole)
8.4 Labelling of water samples
8.5 Transportation and storage of samples
8.6 Quality assurance and quality control in drinking-water sampling
8.6.1 Multiple sampling
8.6.2 Duplicate samples

8.6.3 Blank sampling

9.0 Drinking-Water Testing Methods

9.1 Onsite water quality testing
9.1.1 Observation
9.1.2 Presence/absence tests
9.1.3 Use of portable labs
9.2 Offsite / centralised laboratory
9.3 Microbiological testing methods
9.3.1 Presence/absence test
9.3.2 Most probable number test
9.3.3 Membrane filtration test

9.4 Chemical testing methods

9.4.1 Volumetric titration
9.4.2 Colorimetric methods
9.4.3 Atomic absorption spectrometry
9.4.4 Chromatography
9.4.5 Residual free chlorine test

10.0 Interpretation and Analysis of Drinking-Water Surveillance Data

10.1 Methods of interpreting and analysing water quality surveillance data
10.2 Comparison analysis
10.3 Trend analysis
10.4 Statistical analysis
10.2 Format for drinking-water quality surveillance report: introduction; objectives; materials and methods; results; and conclusion & recommendations.

11. Sanitary Inspections

11.1 Definition of sanitary inspection
11.2 Types of health risks associated with water points
11.3 Frequency of sanitary inspections
11.4 Sanitary inspection forms
11.5 Carrying out sanitary inspections of water supply systems: boreholes with hand pumps; hand dug wells with a windlass; springs; and conventional water treatment plants
11.6 Interpretation of sanitary inspection data
11.7 Writing sanitary inspection report

TEACHING METHODS

1. Lectures
2. Practical

3. Field visits
4. Group discussions
5. Demonstrations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Laboratory work: 2 hours session per week
4. Field work: 2 hours per week
5. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Rangwala, S.C., (2015). **Water supply and sanitary engineering**. Gujarat: Charotar Publishing House.
2. World Health Organization (2011). **Guidelines for drinking-water quality**. Geneva: WHO Press.

RECOMMENDED READINGS

1. World Health Organization (2003). **Assessing microbial safety of drinking water**. Geneva: WHO Press.
2. World Health Organization (2007) **Chemical safety of drinking water: assessing priorities for risk management**. Geneva: WHO Press.
3. World Health Organization (2011) **Evaluating household water treatment options, heath-based targets and microbiological performance specifications**. Geneva: WHO Press. 4. World Health Organization and IRC Water and Sanitation Centre (2003). **Linking technology choice with operation and maintenance in the context of community**

COURSE TITLE: SOLID WASTE AND HEALTH CARE WASTE MANAGEMENT
COURSE CODE: EHS 224

INTRODUCTION

The course forms the basis for equipping students with solid waste management theories, concepts and practices. It also equips the students with knowledge, skills and attitudes to enable them to conduct the hazardous and electronic waste management.

The course is designed to expose students to the management of health-care waste and human remains. The course gives a comprehensive understanding and application of suitable ways of handling these types of wastes including their legislative, regulatory and policy aspects.

COURSE AIM

To enable students acquire knowledge and skills in solid waste and health care waste management including human remains management.

COURSE OBJECTIVES

1. Describe key concepts in solid waste management
2. Explain sources, types and composition of solid wastes
3. Describe various methods used in the collection of waste from domestic houses
4. Elucidate the principles of solid waste management
5. Describe methods of transportation and disposal of solid waste
6. Describe the storage and disposal of hazardous waste
7. Describe the electronic waste
8. Explain key concepts in health-care waste management
9. Describe health-care waste
10. Elucidate impacts of health-care waste on human health and the environment
11. Outline legal and institutional framework for health-care waste management
12. Describe methods of managing health care waste
13. Explain key concepts in human remains management
14. Describe human remains
15. Describe various methods of human remains management
16. Outline legal and institutional framework for human remains management

COURSE LEARNING OUTCOMES

1. State legal and institutional framework for solid waste management in Zambia 2. Enforce solid waste management legislation.
3. Identify international Conventions and treaties on solid waste management

4. Describe solid waste management guiding principles
5. Illustrate integrated solid waste management
6. Monitor types and sources of solid waste being generated in a town.
7. Characterize solid wastes.
8. Identify functional elements of a solid waste management.
9. Evaluate solid waste handling and separation, storage and processing at the source
10. Enumerate various methods of solid waste collection
11. Recommend solid waste segregation, processing, transformation and recovery methods
12. Establish solid waste transfer and transport system for a town
13. Set up a final disposal method of solid wastes
14. Enforce legislation on health-care waste management
15. Establish health care waste management system through statutory inspections for various types of health-care waste facilities
16. Manage treatment and disposal of health-care waste
17. Establish occupational health system in a health-care facility
18. Advocate for the implementation of infection prevention and control measures in health-care institutions
19. Analyse impacts of health-care waste on human health and the environment
20. Monitor the management of health-care waste management plans
21. Evaluate the management of health-care waste management plans

COURSE CONTENT

UNIT ONE: SOLID WASTE MANAGEMENT

Introduction

1.0 Definition of key concepts in solid waste management; solid waste and solid waste management.

1.3 Effects of improperly disposed of solid wastes on human health and the environment

1.4 Legal and institutional framework for solid waste management in Zambia

2.0 International Conventions and treaties on solid waste management:

2.1 Basel Convention

2.2 Bamako Convention

2.3 Stockholm Convention

. Agenda 21

3.0 Solid waste management guiding principles:

3.1 The "polluter pays" principle

3.2 The "precautionary" principle 3.3 The "duty of care" principle

3.2.1 The "principle of cooperation"

3.2.2 The "proximity" principle

3.2.3 The cradle-to-grave principle

3.2.4 The integrated life cycle principle

4.0 Integrated solid waste management:

4.1 Source reduction

4.2 Recycling

4.3 Waste transformation

4.4 Landfilling

4.5 Sources: types and composition of solid wastes

4.6 Moisture content and material balance analysis; application of an EMS using ISO package

5.0 Functional elements of a solid waste management system:

5.1 Solid waste quantities

5.2 Solid waste generation and collection rates

5.3 Factors affecting solid waste generation rates

5.4 Solid waste characterization/analysis

5.5 Solid waste handling and separation, storage and processing at the source

6.0 Solid waste collection

6.1 Kerb-side collection

6.1.1 House-to-house collection

6.1.2 Hauled container system

6.1.3 Stationary container system

6.1.4 Factors affecting collection schedule

7.0 Management of solid waste:

7.1 Solid waste segregation, processing, transformation and recovery

7.2 Solid waste transfer and transport:

7.3 Final disposal of solid wastes

7.4 Refuse pits

7.5 Open dumping

7.6 Compositing

7.7 Incineration (waste to energy)

7.8 Landfill method of solid waste disposal

7.8.1 Landfill classificationtypes and methods;

7.8.2 Landfill siting consideration;

7.8.3 Composition and characteristics of landfill gases

7.8.4 Generation, movement and control of landfill gases

7.8.5 Composition, formation, movement and control of leachate in landfills

7.8.6 Landfill operations

7.8.7 Landfill closure and post closure care.

8.0 **Electronic waste (e-waste) management:**

8.1 Definition of e-waste

8.2 Sources of e-waste and their constituents

8.3 Human toxicity of hazardous substances in e-waste

8.4 Impacts of e-waste on public health

8.5 Environmental impacts of e-waste from disposal processes

8.6 Material flow analysis (MFA)

8.7 Multi-criteria analysis (MCA)

8.8 Extended producer responsibility (EPR) to solve e-waste problems

8.8 Electronic waste management approaches:

8.8.1 Eco-design devices

8.8.2 Collection of e-waste

8.8.3 Recovery of e-waste

8.8.4 Recycling of e-waste

8.8.5 Disposal techniques of e-waste

8.8.6 Public awareness of e-waste impacts on the environment and public health

9.0 Disposal of the dead

9.1 Introduction
9.2 Legal and social considerations
9.3 Mortuary and funeral parlour siting, layout and design
9.4 Autopsies (medical and legal)
9.5 Cremation and incineration
9.6 Siting of burial grounds
9.7 Guidelines related to export, import exhumation and disposal of infectious bodies

UNIT TWO: HEALTH CARE WASTE MANAGEMENT

1.0 Definition and characterization of health-care waste:

1.1 General definition of healthcare waste

1.2 Categories of healthcare waste

1.2.1 Hazardous health-care waste: sharps waste; infectious waste; pathological waste; pharmaceutical waste; cytotoxic waste; chemical waste; and radioactive waste.

1.2.2 Non-hazardous health-care waste

2.0 Sources of health-care waste

2.1 Major sources of health-care waste

2.2 Minor sources of health-care waste

3.0 Risks associated with health-care waste

3.1 Overview of hazards

3.2 Public sensitivity

3.3 Public health impact

4.0 Legislative, regulatory and policy aspects of health-care waste

4.1 Guiding principles:

4.1.1 The "polluter pays" principle

4.1.2 The "precautionary" principle

4.1.3 The ''duty of care" principle

4.1.4 The "proximity" principle

4.1.5 The "prior informed consent principle"

4.2 International agreements and conventions on health-care waste management

4.2.1 The Basel Convention

4.2.2 The Bamako Convention

4.2.3 The Stockholm Convention

4.3 Legal framework for health-care waste management in Zambia

4.4 Institutional framework for health-care waste management in Zambia

5.0 Health-care waste-management planning
5.1 The need for health-care waste management planning
5.2 Development of health- care waste-management plan for a health-care facility
5.3 Implementation of the health-care waste-management plan

6.0 Generation of health-care waste
6.1 Health-care waste minimization, reuse and recycling
6.1.1 Health-care waste minimization
6.1.2 Safe reuse of health-care waste
6.1.3 Recycling of health-care waste

7.0 Segregation, storage and transport of health-care waste
7.1 Segregation systems of health-care waste
7.1.1 Waste segregation
7.1.2 Packaging;
7.1.3 Colour coding
7.1.4 Labeling.
7.1.5 Collection within the health-care facility
7.1.6 Onsite transport of health-care waste
7.1.7 Central storage inside health-care facilities
7.1.8 Offsite transport of health-care waste

8.0 Treatment and disposal options for health-care waste
8.1 Non incineration treatment options
8.1.1 Steam treatment technologies e.g. autoclaves;
8.1.2 Microwave treatment technologies
8.1.3 Dry-heat treatment technologies
8.1.4 Chemical treatment technologies
8.1.5 Encapsulation and inertization
8.1.6 Land disposal.
8.2 Chamber starved-air incinerators
8.3 Multiple chamber incinerators
8.4 Rotary kilns
8.5 Environmental control of incinerators
8.6 Applications of treatment and disposal methods to specific health-care waste categories

9.0 Collection and disposal of health-care wastewater
10.0 Health and safety practices for health-care waste workers
11.0 Hospital infection prevention and control

TEACHING METHODS
1. Lectures

2. Field visits
3. Group discussions
4. Demonstrations
5. Presentations
6. Case studies

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Laboratory work: 2 hours per week
4. Field work: 2 hours session per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1Theory	60%

PRESCRIBED READINGS

1. Tchobanoglous, G., and Kreith, F. (2002). **Handbook of Solid Waste Management.** New York: McGraw-Hill Companies.
2. Tchobanoglous, G., Theisen, H., Vigil, A.S. (2004). **Integrated waste management: Engineering principles and management issues**. New York: McGraw-Hill.

RECOMMENDED READINGS

1. World Health Organization (2005). **Management of Solid Health-Care Waste at Primary Health-Care Centres**. Geneva: WHO Press.
2. Ministry of Health (2015.) **National Health-Care Waste Management Plan 2015 – 2019**. Lusaka: MoH Publication
3. **International Committee of the Red Cross** (2011). **Medical Waste Management**. Geneva: International Committee of the Red Cross.
4. Environmental Council of Zambia (2007). **Technical Guidelines on Sound Management of Health-care Wastes**. Lusaka: ECZ Publication.
5. World Health Organization (2014). **Safe management of wastes from health-care activities**. 2nd Edition. Geneva: WHO Press.
6. World Health Organization (2014). **How to conduct safe and dignified burial of a patient who has died from suspected or confirmed Ebola virus disease**. London: World Health Organization.

COURSE TITLE: MEDICAL ENTOMOLOGY
COURSE CODE: EHS 225

INTRODUCTION

The course is designed to provide students with fundamental principles of medical entomology necessary for the application of appropriate measures in the control of vectors and rodents of medical importance.

COURSE AIM

To equip students with necessary knowledge and skills in the control of arthropods and rodents of medical importance.

COURSE OBJECTIVES

1. Outline arthropods and rodents of medical importance
2. Define different terms used in medical entomology
3. Explain life history / cycle of arthropods
4. Describe vector and rodent borne diseases
5. Explain appropriate interventions used in vector and rodent control

COURSE LEARNING OUTCOMES

1. Conduct Spraying techniques in the control of vectors
2. Distinguish Synanthropic rats from mice
3. Identify eggs and larvae from breeding sites
4. Explain modes of transmission for vector and rodent borne diseases
5. Apply control methods to prevent and control epidemics of vector and rodent borne diseases
6. Differentiate various types of arthropods
7. Use various survey methods to catch vectors
8. Identify snails carrying schistosoma parasites
9. Utilise appropriate measures in the control of vectors and rodents

COURSE CONTENT

1.0 Introduction to Medical Entomology

1.1 Introduction

1.2 Definition of terms

1.3 Classification of arthropods

1.4 Outline of common medical important arthropods (Mosquito, House fly, Cockroach, Blackfly, Fleas, Mites, Ticks, Lice, Bedbugs and Tsetse fly)

1.5 Basic Anatomy

1.6 Life cycles of arthropods of Medical Importance in Zambia

2.0 Vector control

2.1 Vector Status (Affinity, Susceptibility, and Longevity);

2.2 Methods of disease transmission (Mechanical transmission, Biological transmission and Transovarian Transmission);

2.3 Prevention and control Methods for Vectors (Chemical control, Biological Control, Source reduction, Integrated vector management (IVM), and Person protection) 2.4 Resistance (Behavior resistance, Vigor resistance, Physiological resistance)

3.0 Malariology

3.1 Introduction

3.2 Definition and Background

3.3 Lifecycle of Malaria parasite in man and mosquito

3.4 Symptoms and signs of malaria

3.5 Management of Malaria (Uncomplicated Malaria, Complicated Malaria, and Intermittent Preservative Treatment - I.P.T);

3.6 Malaria control Interventions (Indoor Residual Spraying – IRS, Insecticide Treated Nets – ITN, Larval Control, and Environmental Management - Modification, and Manipulation)

3.7 Mosquito control at the Airport

3.8 Zoning concept (Free Zone, Buffer zone, and Protective zone).

4.0 Human African Trypanosomiasis

4.1 Types of tsetse flies and their habitats;

4.2 Tsetse fly and disease; and

4.3 Prevention and Control measures.

5.0 Fumigation process

5.1 Definitions

5.2 Fumigant, fumigator, Grains Silo operator

5.3 Selection of fumigants

5.4 Application equipment and Protective equipment;
5.5 Fumigation by Pest Control operators;
5.6 Safety and health precautions; and first - aid kit.

6.0 Rodent control
6.1 Introduction
6.2 Classification and grouping of rodents
6.3 Common species of rodents
6.4 Rodents and diseases (Plague, Salmonellosis, Rabies, and Murine typhus)
6.5 Rodent surveillance and control in public places (markets, airports, houses, public buildings and silo establishments)
6.6 Safety precaution in rodenticide usage
6.7 Groups of rodenticides
6.8 Organisation of rodent control programme

7.0 Legislation on Medical Entomology and Rodent Control in Zambia
7.1 Public Health Act Cap 295 sect 34 and 67 (1) and (j);
7.2 Public Health Act (infections disease) Regulations 34, 57 and 58
7.3 WHO International Health Regulations (2005) and other International conventions

TEACHING METHODS
1. Lectures
2. Practical
3. Group discussions
4. Demonstrations
5. Field trips
6. Tutorials

NOTIONAL HOURS: 100 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Seminar: 2 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%

2.1 Practical 20%

PRESCRIBED READINGS

1. Jerome. G (2012). **Public Health Entomology.** New York: CRC Press.
2. Gail. M, Jerome. G (2019) **The Goddard Guide to Arthropods of medical importance.** 7th Ed. New York: CRC Press
3. Omolade. O (2012)**. Malaria Parasites.** Lagos: Lagos state University Press

RECOMMENDED READINGS

1. Leo B. (2009) **War and Disease: Biomedical Research on Malaria in Twentieth Centaury.** 1st ed. Retgers University Press

2. World Health Organisation (2006**). Pesticides and their Application, for the control of Vectors and Pests of Public Health Importance**, 6thedn, WHO, Geneva.

YEAR THREE SEMESTER ONE

Course Codes	Course Titles
EHS 311	Principles of Building Design and Building Construction
EHS 312	Communicable and Non-communicable Diseases
EHS 313	Introduction to Principles of Law
EHS 314	Health Promotion and Behavioural Change
EHS 315	Practical Training I

COURSE TITLE: PRINCIPLES OF BUILDING DESIGN AND CONSTRUCTION
COURSE CODE: EHS 311

INTRODUCTION:
Expertise in building construction requires attainment of skills in design, measurement, theory of structures and construction management. This course is intended at introducing students to principles of building design and construction.

COURSE AIM
The course aims ensuring students acquire skills in building design and construction to enable the statutory functions effectively.

COURSE OBJECTIVES
1. Draft building plans
2. Modify building plans reflecting acceptable building standards
3. Describe basic construction principles
4. Interpret building regulations

COURSE LEARNING OUTCOMES
1. Present building drawings in terms of floor plans, sections and elevations.
2. Evaluate the behaviour and design of structures.
3. Practice mathematical skills in measuring building processes
4. Enforce building regulations
5. Manage construction processes

COURSE CONTENT

1.0 Building Construction

1.1 Building Geometry and Draughtsmanship

1.1.1 Basic draughtsmanship
1.1.2 Correct use of drawing instruments and equipment
1.1.2 Lettering and conventional symbols
1.1.3 Construction and use of scale rules, Plan and solid geometry
1.1.4 Projections - Isometric, perspective, parabolas, hyperbolas, and arches
1.1.5 Building terms and definitions.

1.2 Building Drawings

1.2.1 Preparation of drawings to illustrate all aspects of building construction: Foundations, walls, lintels, bonding, chimneys and roofs incorporated into plans, sections and elevations of buildings of public, environmental or occupational health interest

1.3 Basic Construction Principles

1.3.1 Excavations and earthworks
1.3.2 Piling
1.3.3 Concrete works
1.3.4 Brickwork and block work
1.3.5 Roofing
1.3.6 Carpentry and joinery

1.4 Structural steel work

1.1.1 Metal work
1.4.1 Plumbing and engineering installations
1.4.2 Electrical installations
1.4.3 Floor, wall and ceiling finishes
1.4.4 Glazing
1.4.5 Painting
1.4.6 Drainage

2.0 Building Mathematics and Mechanics

2.1 Building Mathematics

2.1.1 Standard International Units of measurements, mensuration - areas and volumes of various

2.1.2 shapes, Trigonometry - Properties and solutions of triangle-sine, cosine and tangents,
2.1.3 Measurement
2.1.4 Standard method of measurement of building works
2.1.5 Taking off building quantities
2.1.6 Bills of quantities and Materials Schedules

2.2 Theory of Structures

2.1.1 Equilibrium, stress and strain, shear force and bending moments,
2.1.2 Principles of design for structural elements (beams, slabs, pillars and buttresses)
2.1.3 Principles of design of buildings/structures

2.3 Single and Multi-storey Buildings

2.3.1 Role of the structural engineer
2.3.2 Foundations: Principles of soil mechanics, principles of design for strip, pad, raft and pile foundations
2.3.3 Structural steel frames: design principles
2.3.4 Concrete structures: design principles
2.3.5 Concrete for multi-story buildings: design principles, reinforced concrete beams, prestressed concrete beams, and floor slab designs

3.0 Practical

3.2 Computer software

3.1.1 Computer Aided Drafting
3.1.2 Measurement software

3.3 Laboratory and Fieldwork

3.3.1 Materials Testing
3.3.2 Visits to construction sites

4.0 Building Management

4.1 Building Materials

4.1.1 Basic material: Soil, cement, lime, asbestos cement, aggregates, water
4.1.2 Traditional: Sun-dried bricks and blocks, adobe, pise'deterre, terracotta, stabilized earth, rubble, wattle and daub
4.1.3 Timber: Common types, seasoning, curing, preservation and storage
4.1.4 Manufactured: Kiln burnt bricks, types of bricks, hollow concrete blocks, stone, tiles
4.1.5 Roof materials: Thatch, galvanised corrugated iron (GCI), Inverted Box Ridge (IBR), asbestos-cement sheeting, tiles, coated GCI
4.1.6 Finishes: Slate, tile, burnt bricks, plastersPaints: Distempers, polyvinyl chloride (PVC) emulsions, undercoats and oil based gloss/matt paints
4.1.7 Reinforcing materials: Round bars, deformed bars, brick-force, Weld-mesh and expanded metal
4.1.8 Concrete-mix design, mixing, placing and curing practice
4.1.9 Bituminous materials

4.1.10 Prefabricated and wooden frame structures

4.2 Material's performance

4.2.1 Stability (structural)
4.2.2 Durability
4.2.3 Environmental issues

4.3 Building Administration

4.3.1 Urban and Regional Planning Act of 2015
4.3.2 Building Regulations and By-laws
4.3.3 Scrutiny of building plans
4.3.4 Building permit applications
4.3.5 Approval of building plans
4.3.6 Inspection of buildings and Occupation Certificates

4.4 Building control: **Urban growth**

4.4.1 Urban drift, population growth, social and health implications
4.4.2 Mega-city growth problems
4.4.3 Analysis of residential patterns and social divisions
4.4.4 Provision and management of housing stock.

4.5 Development layouts:

4.5.1 Appropriate land utilization
4.5.2 Influence of gradients and orientation
4.5.3 Aesthetic considerations, hazards, environmental enhancement

4.6 Apply Environmental Management Act No. 12 of 2011:

4.6.1 Environmental Impact Assessment Regulations.
4.6.2 Objective and principles
4.6.3 Development procedures and Environmental Impact Assessments (EIA)

4.7 Apply Urban and Regional Planning Act of 2015:

4.7.1 Objectives and principles
4.7.2 Development procedure
4.7.3 Zoning principles
4.7.4 Development plans
4.7.5 Land lease restrictions, 'change of user' procedure
4.7.6 Health considerations and conflicting usage.

4.8 Informal development: Haphazard development and its consequences-

4.8.1 Inadequate vehicular access or reserves for subsequent installation of water mains and sewers,

4.8.2 Inadequate open space

4.8.3 Poor sanitation

4.8.4 Inadequate and unsafe water supply

4.8.5 Indiscriminate waste disposal

4.9 Social problems:

4.9.1 Difficulty in enforcing law and order

4.9.2 Moral degradation

4.9.3 High incidence of social problems

4.10 Redevelopment:

4.9.4 Containment of expanded development

4.9.5 Urban renewal concepts

4.10.3 Redevelopment programmes

4.11 Building Contracts

4.11.1 Building plans and specifications

4.11.2 Bills of quantities

4.11.3 Tendering

4.11.4Conditions of Contracts

4.11.4 Schedules of works

4.11.5 Payments and withholding payments

TEACHING METHODS:

1. Lectures
2. Demonstrations at construction sites
3. Group discussion
4. Individual student presentations
5. Field visits

NOTIONAL HOURS: 120 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours session per week
4. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1. Continuous assessment: 40%

1.1 2 Tests: 20%

1.2 2 Assignments: 10%

1.2.3 Practical 10%

2. Final Examinations: 60%
2.1 Theory: 60%
2.2 Practical 20%

PRESCRIBED READINGS

1. Varghese P (2017). **Building Construction.** 2nd ed. Delhi: PHI Learning private limited
2. Norbert L. (2008). **Heating, Cooling, and Lighting: Sustainable Design Method for Architects.** 3rd ed. Wiley publishers

RECOMMENDED READINGS

1. GRZ. (2015). **Urban and Regional Planning Act of the Laws of Zambia**. Lusaka: Government Printers

COURSE TITLE: COMMUNICABLE AND NON-COMMUNICABLE DISEASES
COURSE CODE: EHS 312

INTRODUCTION

The course is designed to prepare students with appropriate knowledge, skills and attitudes to enable them identify and prevent and control various diseases. Management of non-communicable diseases is a multidisciplinary activity which seeks to holistically appreciate the predisposing factors or causes. The course is designed to provide students with fundamental principles of gathering and managing epidemiological data on non-communicable diseases so that management can be appropriately be applied both in terms of prevention and control.

COURSE AIM:

Students should be able to apply knowledge and skills of communicable and non-communicable diseases in a professional attitude thus developing managerial skills in prevention and control of communicable and non-communicable diseases.

COURSE OBJECTIVES:

1. Describe key concepts in communicable diseases
2. Describe signs, symptoms and prevention of communicable diseases
3. Describe signs, symptoms and prevention of non-communicable diseases
4. Outline legislation on communicable and non-communicable diseases
5. Describe neglected tropical diseases of public health importance in Zambia
5. Explain the modes of communication of various infectious diseases.
6. Explain the interaction between host, agent and environmental factors in the aetiology of disease
7. Outline the process of identification, planning and implementation of disease prevention and control
8. Describe types of snails and diseases associated with them
9. Define the term non-communicable disease
10. Explain the epidemiology of non-communicable diseases
11. Discuss the burden of non-communicable disease
12. Describe diabetes in terms of prevalence, causes, general symptoms and management
13. Define hypertension
14. Explain the general causes and predisposing factors of hypertension
15. Explain health implications of obesity
16. Elucidate different types of cancers and their health implications
17. Explain the economic burden of tobacco use

18. Describe methods of control of tobacco use

COURSE LEARNING OUTCOMES:

1. Identify common signs and symptoms of communicable diseases
2. Identify common signs and symptoms of non-communicable diseases
3. Differentiate between communicable and non- communicable disease
4. Formulate a plan for disease control
5. Formulate strategies in the management of communicable diseases,
6. Formulate strategies in the prevention of communicable diseases Formulate strategies in the control of communicable diseases
7. Carry out snail survey
8. Establish the preventive measures in relation to the disease
9. Establish control measures in relation to the diseases
11. Identify neglected tropical diseases of public health importance in Zambia
12. Analyze the interaction between host, agent and environmental factors in the etiology of disease
13. Apply strategies for implementation of disease prevention and control
14. Carry out nails survey to identify the type responsible for disease transmission
15. Apply legislation related to the control of communicable diseases

12 Classify non-communicable diseases

13 Demonstrate understanding of diseases of lifestyle

14 Demonstrate appropriately the skills through working stakeholders in control of non-communicable diseases

15 Analyze the epidemiological data of non-communicable diseases in order to make management decision on the preventive strategies as an 'integrated health team'

16 Enforce legislation related to tobacco use in public places such as taverns/bars, restaurants and other premises

COURSE CONTENT

UNIT ONE: COMMUNICABLE DISEASES

1.0 Introduction to Communicable Diseases

1.1 Definition of terms used in communicable diseases

1.2 Dynamics of disease transmission

1.3 WHO International Health Regulations, 2005.

1.4 Listing diseases, which are notifiable in Zambia as per Public Health Act CAP 295 and other policy documents

2.0 Common communicable diseases in Zambia

2.1 Describe the epidemiology, aetiology, basic manifestations and course, public health impact, prevention, detection and available treatment of the following:

2.1.1 Communicable diseases involving faecal contamination of water, food and other vehicles of transmission:Poliomyelitis, Dysentery, Amoebiasis, Cholera, Typhoid, Paratyphoid, Giardia intestinalis, Salmonellosis, Ascariasis, Enterobiasis and Ancylostomiasis

2.1.2 Communicable diseases caused by ingestion or contact with animals or their products: Rabies, Tetanus Brucellosis, Ebola, Taeniasis, Anthrax, Bovine Spongiform Encephalopathy (BSE) and Weil Disease

2.1.3 Air borne or droplet communicable diseases: Tuberculosis, Whooping cough, Diphtheria, Measles, Mumps, Meningitis, Chicken pox, Small pox , SARS and other virus infections

2.1.4 Communicable diseases involving invertebrate vectors as hosts: Malaria, Bilharzia and Sleeping sickness, Tick fever and other arthropod borne diseases

2.1.5 Sexually transmitted infections: Gonorrhoea, Syphilis, Chancroid, Trichomonasvaginalis, Lymphogranulomavenereum and Acquired Immune Deficiency Syndrome

2.1.6 Contagious communicable diseases: Ringworm, Scabies, Leprosy, Trachoma and Conjunctivitis

2.2 Disease domain examples:

2.1 HIV/AIDS

2.1.1 Epidemiology of HIV/AIDS: History of HIV/AIDS

2.1.1.1 Basic facts about HIV/AIDS: Behaviour and presentation.

2.1.1.2 HIV/AIDS in adults and children: Major signs and symptoms, and mitigating factors.

2.1.2 The impact of HIV/AIDS: Social and economic impact on society (workplace and at home).

2.1.3 Sex and sexuality: Cultural factors, which contribute to HIV/AIDS transmission.

2.1.4 Voluntary counselling and testing: Testing for insurance, recruitment, employment, epidemiological surveillance and voluntary.

2.1.5 Rights and responsibilities for individuals, employers and government.

2.1.6 Prevention and control.

2.2 Tuberculosis (TB)

2.2.1 Epidemiology of TB: History of TB

2.2.1.1 Basic facts about TB: Behaviour and presentation.

2.2.1.2 TB in adults, children and the vulnerable groups: Major signs and symptoms and mitigating factors.

2.3 The impact of TB: Social and economic impact on society (workplace and at home).

2.4 Factors which contribute to TB transmission.

2.5 TB testing (Diagnosis).

2.6 Prevention and control.

3.0 Control of communicable diseases

3.1 Control strategies

3.1.1 The agent (disinfection, treatment)

3.1.2 The transmission route

3.1.3 The host & community (treatment, isolation, quarantine, immunization)

3.1.4 The environment

3.1.4.1 Cleaning and disinfection

3.1.4.2 Types of disinfectants**:** Gaseous, liquid, physical, natural and heat.

3.1.4.3 Methods used in disinfecting premises, different materials and equipment.

UNIT TWO: NON-COMMUNICABLE DISEASES

1.0 Introduction to non-communicable diseases

1.1 Epidemiology of non-communicable diseases (NCDs)

1.2 Importance of NCDs

1.3 Risk factors for NCDs

1.4 Burden of NCDs

2.0 Diabetes:

2.1 Prevalence of diabetes

2.2 Causes of diabetes

2.3 General symptoms of diabetes

2.4 Management of diabetes

2.5 Available tests
2.6 Community diagnosis
2.7 Control schemes of diabetes

3.0 Hypertension:
3.1Prevalence of hypertension
3.2 General symptoms hypertension
3.3 Predisposing factors of hypertension
3.4 Cardiovascular diseases routine screening
3.5 Life style and management

4.0 Cancers
4.1Prevalence and incidence of cancers
4.2 Prevention and control of:
4.2.1 Cervical cancer
4.2.2 Breast cancer
4.2.3 Liver cancer
4.2.4 Prostate cancers

5.0 Tobacco:
5.1 Tobacco use epidemic
5.2 Tobacco and diseases
5.3 Economic burden of smoking
5.4 Second hand smoke
5.5 Smoking cessation/control strategies

6.0 Obesity
6.1Description of obesity
6.2 Incidence of obesity
6.3 Health implications of obesity
6.4 Dietary principles and control
6.5 Life style and social factors

7.0 Common Disorders of Inheritance in Zambia (Sickle Cell Disease)
8.0 Legislation on communicable and non-communicable diseases
4.1 Notifiable diseases in Zambia as per the Public Health Act CAP 295
4.2 International notifiable diseases as per the International Health Regulations of 2005
4.3 Public Health Act Cap 295 Section 9 (1)
8.4 Public Health (Infectious Diseases) Regulations

TEACHING METHODS

1. Lectures
2. Tutorials
2. Group discussions
3. Individual student presentations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Field work: 3 hours session per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment 40%

1.1 2 Tests 30%

1.2 2 Assignments 10%

1.0 Final Examinations 60%

1.1 Theory 60%

PRESCRIBED READINGS

1. Park, K. (2011). **Prevention and Social Medicine.** New Delhi: Prem Nagar,
2. Hawker, J., Begg, N., Blair, et al (2008). **Communicable Disease Control Handbook**. WileyBlackwell
3. Webber, R. (2012) **Communicable Diseases: A Global Perspective.** 4th Edition. London: Cabi.

RECOMMENDED READINGS

1. Wood, C. (2008**). Community Health**. Nairobi: The African Medical and Research Foundation .

COURSE TITLE: INTRODUCTION TO PRINCIPLES OF LAW

COURSE CODE: EHS 313

INTRODUCTION

This course aims to provide a general introduction to the law. It also aims to lay a foundation to the learning of the law with particular reference to the operations, functions and powers of authorised officers within the confines of law.

COURSE AIM

To enable students appreciate the moral and ethical dimensions of public health action and how to address them.

COURSE OBJECTIVES

1. Define the law of tort and distinguish between law of torts and criminal law
2. Demonstrate an understanding of practical skills of court procedures in civil and criminal matters
3. Define the law of tort and distinguish between law of torts and criminal law
4. Demonstrate an understanding of delegated legislation
5. Outline public health laws
6. Outline the principles of public health laws
7. Demonstrate various legislations in public health law
8. Explain the public health ethics

COURSE LEARNING OUTCOMES

1. Use of correct legal procedures when taking actions as well as defending legal proceedings when need arises.
2. Exercise powers as a statutory officer and understand the limitations of those powers in the day to day operations.
3. Demonstrate a clear understanding of the sources of law in Zambia
4. Interpret various public health legislations
5. Enforce public health laws
2. Identifies public health violations
3. Prosecute public health offenders

COURSE CONTENT

1.0 INTRODUCTION TO LAW

1.1 Division of Law

1.1.1 Criminal Law

1.1.1 Civil Law

1.1.2 Substantive Law

1.1.4 Procedural Law

1.2 Legal Process

1.2.1 Sources of law

1.2.1.1 Local Statutory Law (The Constitution; Acts of Parliament; Delegated/ Subsidiary Legislation)

1.2.1.2 The nexus between the Constitution and Acts of Parliament

1.3 English Law

1.3.1 Statutes

1.3.2 Common Law

1.3.3 Equity

1.4 Judicial Decisions

1.4.1 Meaning and effect of precedent

1.4.2 Stare decisis

1.4.3 Ratio decidendi

1.4.4 Obita dicta

1.5 African Customary Law

1.5.1 What is customary Law?

1.5.2 Applicability of Customary Law

1.6 International Treaties

1.7 Writings and Opinions of well-known Jurist

2.0 THE COURTS SYSTEM IN ZAMBIA

2.1 The hierarchy and jurisdiction

2.1.1 Constitutional Court

2.1.2 Supreme Court
2.1.3 High Court
2.1.4 Industrial relations court
2.1.5 Subordinate Courts
2.1.6 Local Courts
2.1.7 Tribunals
2.1.8 Fast Track Courts (Local Authorities)

3.0 STATUTORY INTERPRETATION

3.1 What is a statute?

3.2 Rules of interpretation

- 3.2.1 Literal rule
- 3.2.2 Golden rule
- 3.2.3 Mischief
- 3.2.4 Presumptions
- 3.2.5 Interpretation and general provisions Act Cap 2 of the Laws of Zambia

4.0 THE LAW OF EVIDENCE

4.1 What is evidence?
4.2 Classifications of evidence
4.3 Expert evidence
- 4.3.1 Environmental Health officer
- 4.3.2 Environmental Health Technologist
- 4.3.3 Medical doctor
- 4.3.4 Pathologist
- 4.3.5 Laboratory analyst
- 4.3.6 Veterinary Doctor

4.4 Competence and Compellability of witnesses
4.5 Relevance and weight of evidence
4.6 Production of documents in the Courts of Law

5.0 THE LAW OF TORTS

5.1 Definition of the Law of Torts (distinguish between Tort and Criminal Law)
5.2 Negligence- its elements
5.3 Nuisance- rule in Ryland V Fletcher
5.4 Strict Liability in relation to Public Health Act Cap 295 and Food Safety Act Cap 303 of the Laws of Zambia
5.5 Vicarious Liability
5.6 Product liability
5.7 Breach of Statutory duty
5.8 Defences and remedies

6.0 LAW OF CONTRACT

6.1 Definition of a contract

6.2 Formation of a contract

6.2.1 Offer and acceptance

6.2.2 Intention to create legal relations

6.2.3 Consideration

6.3 Discharge of a Contract

6.4 Defences and remedies

7.0 CRIMINAL LAW

7.1 What is a crime and how it is committed?

7.2 Elements of a crime

7.2.1Mens rea

7.2.2 Actus reus

7.3 Nature and functions of the Criminal Law

7.3.1 Punishment

7.3.1 Deterrence

7.4 Classifications of crimes (Sexual offences and offences against the public)

7.5 Criminal offences under the Public Health Act Cap 295 and Food Safety Act No.7 of 2019 of the Laws of Zambia, Statutory Instruments, By- law, Resolutions etc.

7.0 Defenses in Criminal Law

8.0 PREPARATION OF THE PUBLIC HEALTH CHARGE SHEET AND COMMENCEMENT OF COURT PROCEEDINGS

8.1 Summons

8.2 Charge sheet or indictment

8.3 Statement of facts

8.4 Prosecutions

8.5 Court proceedings

8.5.1 Plea of guilty

8.5.2 Plea of not guilty

8.5.3 Trial

8.5.4 Examination in chief

8.5.5 Cross examination

8.5.6 Re examination

8.5.7 Closure of case

8.5.8 Submissions

8.5.9 Ruling

8.5.10 Defence (if put on defence same procedure if not acquittal)

8.5.11 Judgment (if convicted then mitigation; if not convicted then acquittal)

8.5.12 Sentence / Appeals (Withdraw / discharge)

9.0 CITATIONS OF THE LAWS OF ZAMBIA

9.1 Acts of Parliament

9.2 Statutory Instruments

9.2.1 By –Laws

9.2.2 Regulations

9.2.3 Resolutions

10.0 HEALTH STATUTES

10.1 The Public Health Act, Cap 295 of the Laws of Zambia

10.2 The Food Safety Act No. 7 of 2019 of the Laws of Zambia

10.3 Liquor Licensing Act No. 20 of 2011 of the Laws of Zambia

10.4 ZEMA Act No. 12 of 2011 of the Laws of Zambia

10.5 The Factories Act, Cap 441 of the Laws of Zambia

10.6 Local Government Act No. 2 of 2019 of the laws of Zambia

10.7 Chiefs Act Cap 287 of the Laws of Zambia

10.8 Village and Development Act Cap 289 of the Laws of Zambia

10.9 Urban and Regional Planning Act of 2015 of the Laws of Zambia

10.10 Narcotic and Psychotropic Substances Act Cap 96 of the Laws of Zambia and their Regulations

10.11 Water Supply and Sanitation Act (No. 28 of 1997)

10.12 Trades Licensing Act. Cap 393

10.13 Standards Act. Cap. 416

10.14 Factories Act Cap 441

10.14 Criminal Procedure Code Act. Cap 88

10.15 Penal Code Act. Cap. 113

10.16 Hotels Act Cap. 153

10.16 Prevention of Cruelty to Animals Act. Cap. 245

10.17 Stock Diseases Act. Cap. 252; and Regulations there under

10.18 Solid Waste Management and Regulation Act No. 20 of 2018

11.0 ENFORCEMENT AGENCIES AND AUTHORISATION LOCAL GOVERNMENT

11.1 Central government and District Health Offices;

11.2 Health Inspectors, Pharmacy and Poison Inspectors,

11.3 Chemical Inspectors, Health and Safety Inspectors and Factory Inspectors

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
6. Presentations

7. Attending court sessions

NOTIONAL HOURS: 80 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Court report	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Court report	20%

PRESCRIBED READINGS

1. Hage. J, Akermans. B (2014) **Introduction to Law**. Switzerland: Springer International Publishers

RECOMMENDEDREADINGS

1. Poonam. D, Snnath. R. (2017). **International Encyclopedia of Public Health Law**. 2nd ed. Science Direct Publishers

COURSE TITLE: HEALTH PROMOTION AND BEHAVIOURAL CHANGE
COURSE CODE: EHS 314

INTRODUCTION

The course provides a broad ecological perspective on health behaviour and health promotion, including understanding the scope and purpose of health behaviour theories, and identifying what is most relevant from those theories that may be applied in practice, thus enabling people to increase control over and to improve their health" (Ottawa Charter, First International Conference of Health Promotion, 1986).

COURSE AIM

The course aims to equip students with knowledge, skills and attitudes in the development, implementation, and evaluating programs for helping individuals and communities adopt and maintain healthy lifestyles, particularly those useful for helping individuals and communities change their behaviours and improve their environments.

COURSE OBJECTIVES

1. Explain the concept of health
2. Elucidate the broader determinants of health
3. Define the key terms in health promotion
4. Explain the basic concepts, milestones, and approaches to health promotion 4. Explain health promotion from public health perspectives
5. Discuss the process of project planning and management.
6. Describe group dynamic skills in working with the community
7. Describe health promotion activities.
1. Describe the theories and models in health promotion as well as their limitations.
2. Explain a range of societal, social, group-oriented, and individual strategies and actions for health promotion

COURSE LEARNING OUTCOMES:

1. Differentiate between Health Promotion And Health Education
2. Apply principles of health promotion in the management of community projects/programmes
3. Demonstrate ability to conduct health education to the community
4. Conduct community diagnosis
5. Network with stakeholders in promoting health.
6. Apply ethical issues in carrying out Health promotion in carrying out community activities
7. Use health education principles in communicating with the community.
8. Utilize strategies of health promotion in carrying out community health activities
9. Write project proposals to enhance health promotion activities.

10. Identify and address gender health related problems
11. Carry out health promotion activities with a gender perspective.
12. Plan health promotion programmes in collaboration with stakeholders.
13. Apply group dynamic skills in working with the community.

COURSE CONTENT

1.0 **Introduction**

1.1 The concept of health
1.2 Dimensions of health
1.3 Holistic approach to health
1.4 Social determinants of health
1.5 Lay and professional concepts of health
1.6 Key/Common Terminologies (Health Equity, Life style, Social class)

2.0 Description of Health Promotion

2.1 The concept 'Health promotion'
2.3 Core values of Health Promotion
2.4 Principles of Health Promotion Strategies of Health Promotion
2.5 Principles (Values) of a Health Promoter
2.6 Health promotion in practice (Local examples/activities)

3.0 **The development of Health Promotion (Historical Perspective*)***

3.1 Background of the Lalonde Report
3.2 The Bangkok charter
3.2 The Ottawa charter
3.3 Health field concept of Marc Lalonde
3.4 Alma Ata and the primary health care movement
3.5 Relevance and application of global health promotion conferences to Zambia.

4.0 Approaches to health promotion

4.1 The disease prevention approach
4.1 The educational approach
4.3 The ecological approach
4.4 The empowerment approach
4.5 The regulatory approach

5.0 Health Education – Its theory and practice

5.1 Definition of health education
5.2 Theories applied in health education practice
5.3 Health promotion vs Health education
5.3.1 Relationship between health promotion and health education
5.2.2 Characteristics (features) of health promotion

5.2.3 Characteristics (features) of health education
5.3 Participatory techniques in health education
5.4 Concepts of teaching and learning
5.5 Domains of learning
5.6 Learning health behaviour outcomes
5.7 Learning theories- John Dewey and Paulo Freire
5.8 Lesson plan in teaching
5.9 Principles of teaching
5.10 How adults learn

6.0 The role of NGOs in promoting health

6.1 Definition of the term 'NGO'
6.2 The significance of NGOs in promoting health
6.3 Background of NGOs/ Act governing NGOs in Zambia
6.4 Terms for non-profit organisations
6.5 The concept philanthropy- the spirit of giving
6.6 Classifications of NGOs
6.7 Health Activities of NGOs in Zambia

7.0 Health and Poverty

7.1 Definition of 'Poverty'
7.2 Types of poverty
7.3 Measuring poverty

7.4 How poverty causes people's restriction
7.5 How poverty affects women
7.6 Available evidence on poverty & health (How poverty affect the health of an individual)
7.7 Physical, Psychological and behavioral effects of poverty
7.8 Interventions to combat poverty

8.0 Health and Projects

8.1 Definition of the term 'Project'
8.2 Characteristic features of a project (Project fundamentals)
8.3 Project triangle
8.4 The significance of projects in health
8.5 Project life cycle
8.6 The role of the project manager
9.7 The Qualities of the project manager
9.8 Project proposal writing
9.9 The role of the sponsor /donor in the project

9.0 Gender and Health

9.1 Definition of the concept 'Gender'
9.2 Gender and Sex
9.3 Gender disparities in relation to health
9.4 Gender needs, Concerns and Issues
9.5 Interventions to eradicate gender inequalities

10.0 Behaviour Change

10.1 Definition of the term 'Behaviour'
10.2 Healthy Behaviours Vs Health Risk Behaviours
10.3 Healthier Lifestyle
10.4 Behavioural change theories and their application to health promotion
10.5 Positive behaviour change in health

11.0 Working in a Team

11.1 Definition of the term 'Team'
11.2 Characteristics of a team
11.3 Belbin's team roles
11.4 An effective health team
11.5 Significance of leadership in a team

13.0 Networking in Health Promotion
13.1 Definition of the term Networking
13.2 Types of networking
13.3 Health importance of networking

13.0 Contribution of Education to Health Promotion
13.1 Definition of the concept Education
13.2 Types of Education
13.3 Aims of Education
13.4 Benefits of education to the girl child
13.5 Naturalism versus Environmentalism
13.6 Effective education

14.0 Planning Interventions in Health Promotion
14.1Definition of Planning
14.2 Terminologies
14.3 Reasons for planning
14.4 Stakeholders in planning
14.5 Types of Planning

14.6 Planning models

15.0 Strategic Management in Health Promotion
15.1 Definition of a strategy
15.2 Types of strategies
15.3 Being a good strategist
15.4 Process of developing a strategy
15.5 SWOT Analysis
15.6 Importance of strategic management in health promotion

16.0Evidence based practice in Health Promotion
16.1 Definition of Evidence based practice
16.2 What elements contribute to Evidence based practice
16.3 What counts as evidence?
16.4 Types of Evidence
16.5 How Evidence based practice contribute to health promotion development

17.0Research for health promotion practice
17.1 Nature of research
17.2Importance of research health promoters
17.3 What is research?
17.3.1 Uses of epidemiology
17.3 2 Methods used
17.4 Positivist & interpretive paradigms
17.5 The differences between quantitative & qualitative research
17.6 Research for health promotion
17.7 The practitioner-researcher

18.0 **Ethical Issues in Health Promotion**
18.1 Philosophy of health promotion
18.2 Duties in health promotion
18.3 Ethical principles
18.4 Significance of ethics in health promotion

19.0 **Emerging issues in Health Promotion**
19.1 Health promotion & IT
19.2 Gender based violence 19.3 Men's health
19.4 Human Trafficking
19.5 Happiness index

20.0 The Future of Health Promotion
20.1Based on theoretical and practical experience

20.2 Where does health promotion stand?
20.3 If the future is bright, what is the justification?
20.4 Areas to think about:
- 20.4.1 The concept 'Health'
- 20.4.2 The meaning of 'Promotion'
- 20.4.2 Aim of health promotion
- 20.4.3 Health Equity
- 20.4.4 Information technology (IT)
- 20.4.5 Research
- 20.4.6 Sustainable development goals (SDGs)

TEACHING METHODS

1. Lectures
2. Tutorials
3. Field work
4. Group discussions
5. Presentations

NOTIONAL HOURS: 100 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 **Continuous assessment**	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2.0 Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS

1. Edelman, C.L.,Mandle, C.L.&Kudzma, E.C. (2013).**Health Promotion throughout the lifespan.**Philadelphia: Elsevier.
2. Angela. S. (2017) **Promoting Health: A Practical Guide.** 7th ed. London: Elsevier Publishers
3. Pip. M. (2018) **Health Behaviour Change.** 3rd ed. London: Elsevier publishers

RECOMMENDED READINGS

1. Carl. I, Diane. D (2010). **Health Promotion Programes: From Theory to Practice.** 2nd ed. New York: Wiley and Sons Publishes

2. Ken. B., Angela. S. et al. (2014). **Public Health Mini Guides: Alcohol Misuse**. 1st ed. London: Elsevier Publishers
3. Josie. E. (2015). **Public Health Mini Guides: Diabetes.** 1st ed. London: Elsevier Publishers

COURSE TITLE: PRACTICAL TRAINING 1
COURSE CODE: EHS 315

INTRODUCTION

The course is designed to expose students' to rural and urban communities (Community Health) for them to gain practical experience and therefore students' attachment to district health offices is of great significance at this stage. The practical experience gained during this course provides an acquisition of skills and attitude in various disciplines of environmental health such as disease control, public health administration, water quality monitoring, sanitation, meat inspection, waste management, food safety, pest control and chemical safety.

COURSE AIM

To enable students demonstrate the application of skills in the running of rural and urban public health services.

COURSE OBJECTIVES

At the end of the course the student should be able to:

1. Describe strategies of disease control
2. Explain administrative procedures in a public health office
3. Describe the procedure of conducting water surveillance
4. Explain the processes of waste water treatment
5. Describe the procedure of conducting meat inspection
6. Describe principles of food safety
7. Describe the safety measures when dealing with chemicals

COURSE LEARNING OUTCOMES

1. Carryout control of communicable disease operations.
2. Conduct inspection of premises and assess whether premises subject to product specific hygiene regulations satisfy the requirement of those regulations
3. Conduct Health Education as a tool in the control of communicable diseases 4. Collect water samples for biological and chemical analysis
5. Conduct meat and other foods inspections.
6. Conduct spraying operations
7. Conduct inspection of carcasses for food animals and take appropriate action according to Public Health Act.
8. Take water samples
9. Carry out surveillance in water supply, sanitation and sewerage systems

10. Conduct inspection of food premises, rest houses schools, lodges, hotels etc
11. Demonstrate the ability to deal with emergency situations in order to prevent and control epidemics
12. Demonstrate the ability to inspect and assess whether premises subject to product specific hygiene regulations satisfy the requirement of those regulations.
13. Demonstrate the ability to identify food not of the nature, or substance, or quality demanded or that is falsely described or presented, and to determine the most appropriate course of action.
14. Demonstrate your ability to (a) identify food safety hazards and critical control points in the preparation and handling of food indifferent types of premises, (b) audit documented food safety systems (or, where no documented food safety system is available, to propose safeguards to deal properly with any identified food safety hazards), (c) determine a food hygiene inspection priority rating. 15. Demonstrate understanding of the requirements for butchers' shop licensing.
16. Demonstrate the ability to identify housing defects and to be aware of when defects would contribute to a determination that a property is unfit for human habitation, having regard to current methods of determining fitness.

COURSE CONTENT

1.0 **COMMUNITY HEALTH**

1.1 Attend at least one or more district health management team meetings, district health board meetings and at least one sub-committee.

1.2 Investigate at least four different types of potential nuisances or conditions prejudicial to health.

1.3 Recognise and understand at least four different pest infestations, two of which must involve different invertebrate pests e.g. wasps, cockroaches, pharaohs ants etc. and two of which must involve mammalian or avian pests e.g. rats, mice, bats, etc

1.4 Identify three potential epidemics of disease and implement control measures, monitor continued development and recurrence.

1.5 Demonstrate your knowledge of the procedures to be followed in dealing with premises and/or persons found to be in a filthy and/or verminous condition by documenting your involvement with at least one actual or suspected case

2.0 FOOD SAFETY

1.1 Inspect one premises under Public Health (Meat, abattoir and butcheries) Regulations

1.2 Inspect one restaurant approved under the Food Safety Act

1.3 Inspect either (a) a dairy or (b) a daily products plant approved under the Public Health (Milk products) Regulations and Dairy and Dairy Produce Act Cap 230

1.4 Inspect at least one of each of the following types of premises: A food retailer (not being a butcher) selling a range of open foodstuffs; A restaurant, café or canteen; A takeaway facility (not being combined with 'eat in' premises), either static or mobile; a hotel kitchen rated 3-5 stars; bakery, confectionary, meat processing/canning and ice cream manufacturing; A thermal processing plant, e.g., one undertaking canning, aseptic packaging or pasteurisation; and a milling plant.

1.4 Document your involvement with at least two cases of food not of the nature, or substance, or quality demanded or that is wrongly labelled

1.5 Investigate two cases of food poisoning and foodborne disease, of which at least one should have been an outbreak.

1.6 Inspect two butchers' shops that are the subject of butchers' shop licensing.

1.7 Investigate at least two food complaints

3.0 **BUILT ENVIRONMENT**

3.1 Inspect three properties with a view to determining fitness for habitation. At least one of the inspections must be in relation to a dwelling which is, or has been, deemed to be unfit for habitation
3.2 Conduct four investigations into different types of nuisances or conditions likely to be prejudicial to health

4.0 **WATER AND SANITATION**
4.1 Inspect various sources of rural water supplies
4.2 Inspect urban drinking water treatment plants
4.3 Conduct water quality surveillance
4.4 Participate in the construction of sanitary facilities
4.5 Inspect wastewater treatment plants
4.6 Inspect septic tanks and associated soakaways

5 .0 PRACTICAL DEMONSTRATION OF ENVIRONMENTAL HEALTH TOOLS AND EQUIPMENT
5 .1 Spray pump fo r vector control
5 .2 Food probe the rmometers
5 .3 Water quality t esting kit
5 .4 Sound level m eter 5
.5 Luxmeter
5 .6 Personal dosi met er
5.7 Kata thermom eter
5.8 Standing Scale s
5.9 Salter Scales
5.10 Height Scales
5.11 Height measuring Tapes
5.12 Rodent traps

TEACHING METHODS
1. Tutorials
2. Field visits
3. Demonstrations
4. Practical attachment to institutions/organizations/industry
5. Report writing

NOTIONAL HOURS: 80 HOURS
1. Tutorial (Presentations): 1 hour per week
2. Field work: 10 hours session per week
3. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 **Summative assessment:**	**100%**
1.1 Presentation of the report to his/her peer	10%
1.2 Written report	30%
1.3. Practical log book	60%

PRESCRIBED READINGS:

1. Bassett W.H. (2004). **Clay's Handbook of Environmental Health.** London: Spon Press.
2. Koren, H., Bisesi, M. (2003). **Handbook of Environmental Health: Biological, Chemical and Physical agents of Environmentally Related Disease**. Fourth Edition, Vol. 1. New York: Lewis Publishers

RECOMMENDED READINGS

1. Afubwa, S,O., and Mwanthi, A.M. (2014) **Environmental Health and Occupational Health and Safety.** Nairobi: Acrodile Publishing Ltd

2. Stewart, J. (2001). **Environmental Health and Hosing: Clay's Library of Health and the Environment.** Volume 1. London: Spon Press.

3. Fumkin, H. (2010). **Environmental Health: From Global to Local.** Second edition. San Francisco: John Wiley and Sons Ltd.

YEAR THREE SEMESTER TWO

EHS 321	Planned Development and Building Services
EHS 322	Anatomy and Physiology of Food Animals
EHS 323	Toxicology and Chemical Safety
EHS 324	Slaughtering and Slaughter Houses
EHS 325	Inspection of Premises and Reporting

COURSE TITLE: PLANNED DEVELOPMENT AND BUILDING SERVICES
COURSE CODE: EHS 321

INTRODUCTION

Unplanned and haphazard developments produce situations which are deleterious to health, conflict with adjacent usage, impede access and surface drainage schemes, fail to allow for water and waste drainage services and invariably result in the creation of slum conditions. The layout planning, structural soundness, design, lighting, ventilation, amenities and services provided in buildings have a profound effect on the safety and quality of health of those who live-in, workin, or otherwise use them.

COURSE AIM

The course is designed to give students good knowledge and understanding of development planning, construction of buildings, services and amenities required to produce a healthy built environment.

COURSE OBJECTIVES

1. Describe good standards of practice in aspects of building development
2. Scrutinise building plans and technical reports
3. Analyse how urbanization and population dynamics affect the environment
4. Describe drainage from various fittings
5. Identify factors affecting indoor climate
6. Explain safety and comfort standards in buildings
7. Formulate detailed sociological and physical reports on low cost housing stock
8. Develop appropriate technology towards fulfilling community needs
9. Describe enforcement of legal requirements

COURSE LEARNING OUTCOMES

1. Scrutinize and approve building plans
2. Offer advice in relation to building construction
3. Inspect drainage system
4. Inspect and ensure healthy indoor climate
5. Inspect and ensure buildings comply with legal requirements
6. Ensure that the building comply with drainage and latrine regulations
7. Enforce legal requirements pertaining to land use in rural, urban, and peri-urban areas
8. Apply technology towards fulfilling community needs
9. Formulation of sociological and physical reports on low cost housing stock

COURSE CONTENT

1.0 Building Construction

1.1 Siting of Buildings

1.1.1 Topography, Geology, Orientation, Prevailing winds, Access, Services, Social amenities, Health hazards

1.2 Preparation of sites

1.2.1 Gradients and levelling, Surface drainage, Subsoil drainage, Use of topsoil, Temporary amenities for workmen, Temporary services

1.3 Setting-out of buildings

1.3.1 Building lines and spacing of buildings, Setting out site rails and levels, Use of quick set level or alternatives, Use of boning rods, Planning of water, soil and waste drainage and electricity services, Siting of wells in relation to septic tanks and soak ways

1.4 **Construction equipment and formwork**

1.4.1 Tools and equipment, Shuttering and straight edges, Scaffolding, Shoring, props and supports

1.5 Foundations

1.5.1 Design of standard foundations, Excavations, Concrete mixes and mixing, Placing and levelling of concrete, Curing

1.6 Walls

1.6.1 Load bearing walls, sleeper and partition walls, Construction - bonding, reinforcing, jointing and pointing, Damp proof courses for walls and parapets, plasters and plastering

1.7 Openings in walls

1.7.1 Lintels, Ring beams, Sills and thresh holds, Arches and jambs, Ventilators

1.8 Ground and upper floors

1.8.1 Hard cores, Solid and suspended upper floors, Damp proof membranes, Termite protection, Expansion joints, Floor surface finishes

1.9 Ceilings

1.9.1 Height, Materials in common use, Fixing and finishing, Roof space – ventilation and vermin protection

1.10 Roofs

1.10.1 Designs – Lean-to, mono-pitch, couple and close couple, hipped, multiple pitch and flat roofs

1.10.2 Use of Materials – thatch – design, combing, fire protection, Sheeting – asbestos, GCI, Inverted Box Ridge (IBR); aluminium, copper, lead, Tiles – Slates, tiles, shingles, Weatherproofing – Underlay, flashings, gutters, ridges, valleys, Skylights, dormer windows, roof vents,

1.10.3 South lighting

1.11 Chimneys

1.11.1 Flue design, Fire protection, Weather proofing

1.12 Plumbing

1.12.1 Service connection requirements, anti-syphonage protection, piping material, size requirements and jointing, water storage tanks, taps, stop-cocks and non-return valves, sinks, wash hand basins, ablution and laundry facilities

1.13 Legislation: Public Health Act Cap 295 and regulations made there under

2.0 Air and ventilation, Heating, Lighting and Noise

2.1 Air and ventilation

2.1.1 **Normal air:** Chemical and physical composition, Vitiated air, Pollutants

2.1.2 **Natural Ventilation:** Factors affecting natural ventilation-climate, physical space (cubic) and air change, Comfort factors and design

2.1.3 **Mechanical Ventilation:** Exhaust, plenum and balance, Air Conditioning, Hygiene and safety maintenance

2.1.4 **Measurement:** Temperature, Relative Humidity, Air Movement, Effective Temperatures

2.1.5 **Legal Standards:** Requirements for various premises and uses, Space about buildings, Sampling and analysis of air

2.2 Heating

2.2.1 **Definitions**: Sensible heat, Specific heat, Latent heat, Convection, Conduction, Radiation, Insulation of buildings

2.2.2 **Source of Heat**: Solar, Solid fuel, Petroleum products, Electricity and Gas

2.2.3 **Methods of heating and their effects on environment and health**: Traditional braziers, Cookers and stoves, Solar heaters, Central heating and district heating

2.3 Lighting of buildings

2.3.1 **Physics of light**: The eye and seeing, The electro-magnetic spectrum, Photo metric units, Natural laws of light.

2.3.2 **Natural light**: Solar calendar and chart, Orientation of buildings, Fenestration of windows and solar penetration, Solar glare, Roof lighting.

2.3.3 **Artificial light**: Sources of light and relative qualities, Principles of lighting and design.

2.3.4 **Lighting standards**: Measurement of light, Standards for natural lighting and standards for artificial light.

2.4 Noise

2.4.1 Insulation of dividing and party walls, noise from plumbing and waste services

3.0 Housing

3.1 Introduction: Housing unit terminology, impact of housing on health, social and economic considerations, concept of 'homes versus houses'

3.2 Siting: Urban and Regional Planning, environmental considerations

3.3 Housing layout: Housing density, gradients and orientation, traffic hazards and road safety, typical layout plans

3.4 Design of buildings: Objectives, economic considerations, number, shape and use of rooms, layout of rooms, lighting and ventilation, Indoor atmosphere and optimum microclimate, comfort factors, internal insulation, noise control (airborne and impact), fire resistance, food storage, preparation and cooking, ablutions, dish washing and laundry facilities, sanitary accommodation, waste disposal, plumbing and drainage

3.5 Construction of houses: Availability of materials, stability and durability of structural and finishing materials, contemporary materials and relative advantages and disadvantages, modular units, fly, mosquito, vermin and termite protection, burglar proofing and emergency exits

3.6 Inspection of housing: Sociological surveys, standard inspection procedures, overcrowding, structural condition and defects, adequacy of amenities, infestations, environmental nuisances

3.7 Minimum Standards and legislation: Spacing of layouts, size and height of rooms, overcrowding, natural and artificial lighting, natural and artificial ventilation, sanitary accommodation, waste storage and disposal.

4.0 L**ow Cost Housing Techniques and Appropriate Technology**

4.1 Sociological, demographic and physiological aspects of inadequate high density housing

4.2 The approach and conduct of sociological and physiological surveys

4.3 The conduct and compilation of reports on environmental, design, structural and amenity deficiencies

4.4 Multi-disciplinary involvement: Sociologists, psychologists, ecologists, economists, public and environmental health experts and community representatives

4.5 Minimum standards for planning and structure controls, designs, amenities and services including low cost sanitation

4.6 Economic and health aspects of locally available structural and finishing low cost materials

4.7 The manufacture of locally available low cost materials and techniques for their utilization

4.8 Planning housing development and redevelopment: Flow diagram and systems approach

4.9 Itemized quantities and costing (bill of quantity)

4.10 Planning, costing, management and maintenance of public sector housing developments

TEACHING METHODS

1. Lectures
2. Practical
3. Assignments

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hours per week
4. Field work: 3 hours per week
5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.2 Tests	20%
1.2 Assignments	10%
1.3 Practical	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Verghese. P. (2017). **Building Construction**. 2nd ed. Delhi: PHI Learning Private Limited
2. Karl. K, Roger. G., Roy. C. (2019). **Chudley and Greenos Building Construction Handbook**. 12th ed. UK: CRC Press.

PRESCRIBED READINGS

1. GRZ. (2015). **Urban and Regional Planning Act**. Lusaka: Government Printers

COURSE TITLE: ANATOMY AND PHYSIOLOGY OF FOOD ANIMALS
COURSE CODE: EHS 322

INTRODUCTION

The course provides an understanding of the fundamentals of anatomy and physiology of food animals related to structure, cellular and tissue functions. Further the course will equip students with knowledge and skills in parasitological and pathological conditions of food animals

COURSE AIM

To enable students perform the basic steps of the relevant ante-mortem, post-mortem, meat and abattoir inspection processes thus contribute to the production of sound and safe food for human consumption

COURSE OBJECTIVES

1. Explain the life cycles of parasites and their significance in meat inspection
2. Identify parasites that are of public health importance
3. Identify parasites that are of economic (market) importance
4. Identify diseases, pathological conditions and abnormalities to competently pass reasonable judgement on carcasses.
5. Identify symptoms of pathogens that are of economic (market) importance
6. Describe the structure and function of anatomical systems of food animals.
7. Explain the anatomical differentiation of carcasses and organs of various food animals.

COURSE LEARNING OUTCOMES

1. Draw the life cycles of parasites
2. Explain the significance of parasites in meat inspection
3. List parasites that are of public health importance
4. List parasites that are of economic importance
5. Inspect meat and pass judgement on various pathological conditions
6. Identify various organs of food animals
7. Differentiate organs of various food animals
8. Identify signs of pathologies in food animals
9. Draw the structure of anatomical systems of food animals
10. Differentiate between pathological and physiological conditions of food animals

COURSE CONTENT

1.0 Anatomy and physiology of food animals

1.1 Skeletal System

1.1.1 Definitions and description of bones and joints

1.1.2 Comparative anatomy

1.2 Muscular System

1.2.1 Types and functions of muscles

1.2.2 Division into voluntary muscles, involuntary muscles and cardiac muscles

1.2.3 Comparative of flesh of various food animals

1.3 Digestive System

1.3.1 Functions of various organs

1.3.2 Digestive and alimentary canal comprising mouth, tongue, hard and soft palate and salivary glands of the head as accessory glands of digestion

1.3.3 Others; Pharynx, oesophagus, stomachs, large and small intestines, liver and pancreas

1.3.4 Comparative description of these organs in various food animals

1.5 Respiratory System

1.5.1 General description

1.5.2 Functions and distinguishing features in various food animals of: Nostrils, nasal chambers, pharynx, trachea, lungs, bronchi, diaphram and chest muscles

1.6 Circulatory System

1.6.1 General description and functions of blood, arteries, veins and capillaries

1.6.2 Systemic and portal systems

1.6.3 Heart and distinguishing feature

1.6.4 Spleen and distinguishing features

1.6.5 Relationship with lymphatic system

1.6.6 Functions of endocrine and ductless glands in circulatory system

1.7 Lymphatic System

1.7.1 General description and function of lymph, lymph vessels and lymph nodes

1.7.2 Position and function of:- Parotid, sub – maxillary, retropharyngeal, cervical, pectoral, prescapular, sub-dorsal, sub-sternal, popliteal, ischiatic, precrural, superficial, inguinal / supra mammary, iliac, anal, gastric, mesenteric, bronchial and mediastinal lymph nodes

1.8 Nervous System

1.8.1 General description of brain, spinal cord and nerves

1.9 Excretory and Reproductive Systems

1.9.1 Kidneys, ureters, urinary bladder and genital organs

1.9.2 Reasons for castrating male animals

1.10 Endocrine System

1.10.1 Functions of ductless glands

TEACHING METHODS

1. Lectures
2. Practical
3. Tutorials
4. Group discussions
5. Individual presentations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Laboratory work: 2 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.2.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Philip. C., Victoria A., Melonie C. (2019)**. Introduction to Animal Vertrinary, Anatomy and Physiology**. 4th ed. London. CAP International.
2. Rowen D. Frandson. W. (2009). **Anatomy and Physiology of Farm Animals.** 7th ed. New York: Wiley Blackwell.

RECOMMENDED BOOKS

1. FAO (2019). Techinical Guidance Principles of Risk- Based Meat Inspection and Their Application. Rome: FAO

2. Bassett, H. W. (1995). **Clay's Handbook of Environmental Health.** London: Chapman and Hall
3. GRZ (2019). **Food Safety Act No. 7 of the Laws of Zambia.** Lusaka: Government Printers.

COURSE TITLE: TOXICOLOGY AND CHEMICAL SAFETY
COURSE CODE: EHS 323

INTRODUCTION

This course provides students with an understanding of the various concepts in chemical safety and management. It focuses on toxic substances and pesticides and explains the procedures for enforcement of pesticides and toxic substance legislation.

COURSE AIM

To enable students demonstrate the knowledge, skills and attitudes in chemical safety and management.

COURSE OBJECTIVES

1. Define key concepts in chemical safety.
2. Outline the sources and classification of pesticides and toxic substances
3. Explain key concepts in toxicology
4. Explain the exposure pathways to pesticides and toxic substances
5. Explain the classification of toxic substances according to their sources
6. Explain the classification of pesticides according to use
7. Describe the risks associated with the use of pesticides and toxic substances
8. Recommend appropriate ways of ensuring pesticide and toxic substances safety Enforce pesticides and toxic substance legislation

COURSE LEARNING OUTCOMES

1. Apply concepts of chemical safety in the management of chemicals.
2. Classify public health chemicals
3. Classify toxic substances according to their sources.
4. Explain key concepts in toxicology
5. Illustrate the exposure pathways to pesticides and toxic substances
6. State maximum residual limits for pesticides in food
7. Identify risks associated with the use of pesticides and toxic substances
8. Classify pesticides according to use
9. Illustrate the labelling requirements for pesticides and toxic substances in Zambia.
10. Monitor the transportation, storage and disposal of pesticides and toxic substances
11. Conduct compliance monitoring of premises that deals in pesticides and toxic Substances
12. Enumerate impacts of pesticides and toxic substances on human health
13. Enforce pesticides and toxic substances legislation
14. Interpret International Conventions and Agreements in pesticides and toxic substances Safety
15. Recommend appropriate ways of ensuring pesticide and toxic substances safety

16. Enforce pesticides and toxic substance legislation

COURSE CONTENT

1.0 Introduction to Chemical Safety

1.1 Introduction to chemical safety

1.2 Definition of terms; chemical safety, pesticide, and toxic substance.

1.3 History of the use of pesticides; the story of DDT, Minamata disease and Bhopal accident.

2.0 Sources and Classification of Pesticides and Other Toxic Substances

2.1 Sources of toxic substances: mining industries; chemical industries; pharmaceutical industries; waste disposal industries; manufacturing industries and agro industries.

2.2 Classification of toxic substances according to their sources: industrial chemicals; agro chemicals and pharmaceutical chemicals.

2.3 Classification of pesticides according to use: insecticides; fungicides; herbicides; plant growth regulators; insect growth regulators; rodenticides; and ovicides.

2.4 Classification of public health chemicals:

2.4.1 Insecticides; organophosphates, carbamates, organochlorines, and pyrethroids.

2.4.2 Rodenticides; warfarin, warfarin derivatives, calciferol, fluoroacetates, and metal phosphides.

3.0 **Toxicology**

3.1 Introduction to Toxicology

3.1.1 Definition of key concepts in toxicology

3.1.2 Dose-response relationship

3.1.2.1 Dose response curve

3.1.2.2 Determination of LD50, LC50, NOAEL, NOEL and LOEL

3.2 Exposure pathways to pesticides and toxic substances:

3.2.1 Definition of exposure**;**

3.2.2 Routes of exposure to pesticides and toxic substances: inhalation; ingestion; and dermal.

3.2.3 Types of exposure: acute exposure; and chronic exposure

4.0 Risks Associated with the Use of Pesticides and Other Toxic Substances

4.1 Impacts of pesticides and toxic substances on human health

4.1.1 Effects of pesticides and toxic substances at cellular level

4.1.2 Adverse effects: local or systemic; immediate or delayed; reversible or irreversible; additive or antagonistic or synergistic; potentiation or tolerance or resistance and idiosyncratic reaction

4.1.3 Human health impacts: accumulation in the body; cancer; reproductive toxicity; endocrine toxicity; neurotoxicity; and immunotoxicity

4.1.4 Factors that affect the toxicity of chemical: chemical structure of the chemical; dose; biological activity; route of entry; age; and health status.

4.2 Impact of pesticides and toxic substances on the Environment: aquatic toxicity; ground water contamination; effects on wildlife; effects on microbes; bioaccumulation; and biomagnification.

4.3 Pesticide residues in food:

4.3.1 Definition of pesticide residues.

4.3.2 Preventive measures to reduce amounts of pesticide residues

4.3.3 Limitations of preventive measures

4.3.4 Setting maximum residue limits for pesticides in food

4.3.5 Maximum residue limits for pesticides in food for Zambia

5.0 Pesticides and Other Toxic Substances Safety

5.1 Handling of pesticides and toxic substances

5.1.1 Safety and management: knowledge; and engineering controls

5.1.2 Personal protective equipment in accordance with Regulation 51 (2) of the Environmental Management (Licensing) Regulations of 2013.

5.2 Labelling of pesticides and toxic substances

5.2.1 Identification of pesticides: common name or approved name; proprietary name or trade name; active ingredient; formulation; and formulant.

5.2.2 Labelling of pesticides and toxic substances in accordance with the 11th schedule of the Environmental Management (Licensing) Regulations of 2013.

5.2.3 Pictograms on containers for pesticides in accordance with the 11th schedule of the Environmental Management (Licensing) Regulations of 2013.

5.2.4 Colour coding classification for pesticides in accordance with the 11th schedule of the Environmental Management (Licensing) Regulations of 2013.

5.2.5 Importance of Safety Data Sheets for pesticides and toxic substances

5.3 Transportation, storage, and disposal options for pesticides and toxic substances

5.3.1 Transportation of pesticides and toxic substances in accordance with the 10th Schedule of the Environmental Management (Licensing) Regulations

5.3.2 Storage conditions for pesticides and toxic substances in accordance with the 12th Schedule of the Environmental Management (Licensing) Regulations

5.3.3 Disposal options for pesticides and toxic substances in accordance with the 13th Schedule of the Environmental Management (Licensing) Regulations

6.0 **Enforcement of Pesticides and Other Toxic Substances Legislation**

6.1 Licensing of pesticides and toxic substances premises in accordance with provisions of the Environmental Management Act No. 12 of 2011, and Environmental Management (Licensing) Regulations of 2013

6.1 Compliance monitoring of pesticides and toxic substances premises
6.2 Enforcement of pesticides and toxic substances legislation
6.3 International Conventions and Agreements in pesticides and toxic substances safety
    6.4.1 The Rotterdam Convention
    6.4.2 The Stockholm Convention
    6.4.3 The Basel Convention
    6.4.4 The Bamako Convention.

TEACHING METHODS

1. Lectures
2. Tutorials
3. Problem based learning
4. Field visits
5. Group discussions
6. Demonstrations
7. Case studies

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Field work: 2 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS

1. Government of the Republic of Zambia (2011). **Environmental Management Act of 2011**. Lusaka: Governmental Stores

RECOMMENDED READINGS

1. Government of the Republic of Zambia (2011). **Environmental Management (Licensing) Regulations of 2014**. Lusaka: Governmental Stores
2. FAO (2006). **Guidelines on Compliance and Enforcement of a Pesticide Regulatory Programme.** Rome: FAO Publication.

3. World Health Organization (2013). **Environmental Management (Licensing) Regulations of 2013**. Lusaka: Governmental Stores

COURSE TITLE: SLAUGHTERING AND SLAUGHTER HOUSES
COURSE CODE: EHS 324

INTRODUCTION

The course provides in-depth understanding of slaughtering and slaughterhouses of food animals. A well-planned, well-executed and controlled slaughter house is one that protects the products against unintended contamination and therefore students should conform to the HACCP procedures in slaughterhouses. This prevents contamination of premises, equipment, carcasses and personnel and facilitates appropriate control, disinfection and preventive measure to be taken to avoid the spread of diseases.

COURSE AIM

To equip students with knowledge, skills and attitude in conducting ante-mortem inspection before slaughter of food animals in order to screen out suspected diseased or injured animals for isolation slaughter, and also use ante-mortem inspection to support the extensive post-mortem inspection and condemnation judgment.

COURSE LEARNING OUTCOMES

1. Describe various types of food animals
2. Explain the layout and management of a slaughter house
3. Describe the Flow-diagram showing the principles in a slaughtering process.
4. Elucidate methods of slaughtering food animals 5. Explain the HACCP procedures in slaughterhouses.
6. Describe the process of conducting ante mortem inspection
7. Explain the legal requirements of transporting food animals, carcasses including meat products from one place or district to another
8. Explain the legal requirements for the disposal of condemned meat/carcasse; food animal suspected to be infectious; food animal found moribund

COURSE LEARNING OUTCOMES

1. Illustrate the Flow-diagram showing the principles in a slaughtering process.
2. Name various types of food animals
3. Demonstrate the understanding of legal requirements of slaughter of food animals; transportation of food animals, carcasses and meat products
4. Conduct ante mortem and post mortem inspections in line with legal requirements
5. Follow the procedure of disposal of condemned meat/carcass as outlined by the law
6. Apply different methods of slaughtering animals

7. Enforce HACCP procedures in slaughterhouses to prevent contamination of premises, equipment, carcasses and personnel
8. Make prudent and reasonable condemnation judgment in line with legal requirements

COURSE CONTENT

1.0 Food animals

1.1 Names of various food animals:

1.1.1 Bovine; Bull, heifer, cow, steer (bullock), stag (stirk), calf, bobby calf, slink calf and yearling,

1.1.2 Sheep; lamb, ram (tup), whether (hogg), gimmer, ewe and cast ewe

1.1.3 Porcine; Boar, hog, stag, rig (cryptorchid), gelt, sow, piglet (suckling pig), porker and baconer

1.2 Names of common breeds

1.3 Slaughter houses

1.3.1 Siting, planning and design features

1.3.2 Construction, equipment and services required

1.3.3 Model layout for slaughter houses

1.3.4 Management of slaughter houses

1.4.5 Slaughter house hygiene practices

1.4 Slaughtering of animals

1.4.1 Lairage, stunning, bleeding, dressing and hanging

1.4.2 Jewish and Mohammedan rituals

1.4.3 Rigor mortis

1.4.4 Jointing of carcass

1.4.5 Appearance and characteristics of fresh, frozen, chilled and cured meat

1.4.6 Transportation of meat

1.5 By-products

1.5.1 The hygienic processing of by-products and their use: Stomachs, intestines, glandular products, fats, bones, horns, hooves, blood, lard, dripping, suet, gelatine, meat extracts

1.5.2 Disposal of condemned meat

1.6 Transport of meat animals

1.6.1 Loss of weight during transportation

1.6.2 Affections induced during transportation

1.6.3 Effects of stress during transportation and use of tranquillisers

1.6.4 The treatment of animals prior to slaughter

1.6.5 Resting, watering and feeding

TEACHING METHODS

1. Lectures

7. Tutorials
8. Field Visits
9. Group discussions
10. Individual student presentations

NOTIONAL HOURS: 70 HOURS

1. Lectures: 3 hours per week
2. Field work: 1 hour per week
3. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0	**Continuous assessment**	**40%**
1.1	2 Tests	30%
1.2	2 Assignments	10%
1.0	**Final Examinations**	**60%**
1.1	Theory	60%

PRESCRIBED READINGS

1. Hannu. K. Janne. L. (2014). **Meat Inspection and Control in the Slaughterhouse**. NewYork: John Wiley and Sons Inc.
2. Dr. Ashraf. M., Dr. Ghaoutic. C. et al. (2014). **Slaughterhouse inspection (Egypt).** 1st ed. Wageningen: Center of development innovation

RECOMMENDED READINGS

1. GRZ (2019). **Food Safety Act No. 7 of the Laws of Zambia.** Lusaka: Government Printers.
2. Bassett, H. W. (1995). **Clay's Handbook of Environmental Health.** London, Chapman and Hall

COURSE TITLE: INSPECTION OF PREMISES AND REPORTING
COURSE CODE: EHS 325

INTRODUCTION

Inspection of premises and reporting is an important aspect of promoting a healthy environment. This course enables students to acquire knowledge and competency of inspection of different types of premises to ensure that they comply with Public Health Act CAP 295, Food Safety Act No. 7 of 2019 and Occupation Health and Safety Act of 2010.

COURSE AIM

To equip students with the skills required in conducting inspections of buildings and places of environmental health concern, to compile formal reports and to take appropriate action to deal with any issue of environmental health concern.

COURSE OBJECTIVES

1. Acquire knowledge of professional ethics and conduct of inspectors.
2. Acquire knowledge of the design, construction and state of repair of public buildings, food premises, swimming pools, schools, factories, trading and recreation places
3. Identify defects in buildings in which we live, work or seek recreation.
4. Acquire knowledge and understanding of the sciences and legislation related to the built environment to conduct inspections and compile reports
5. Identify the role and functioning of other agencies involved in housing and be able to interact with them in order to resolve any unsatisfactory circumstances
6. Carry out community surveys and compile comprehensive reports
7. Carry out detailed health and safety inspections of premises, as required by Public Health Act Cap 295, Food Safety Act Cap 303 and Occupation Health and Safety Act 2010.
8. Appraise and report on the suitability of the siting, construction, design and structural condition of all buildings
9. Make the necessary recommendations to ensure compliance with legal and environmental health standards

COURSE LEARNING OUTCOMES

1. Conduct inspection of premises according to the requirements of the Public Health Act Cap 295 and Food Safety Act No. 7 of 2019 and Occupational Health and Safety 2010
2. Identification of defects in premises
3. Describing defects in premises in such a manner that it can be used in the courts of law
4. Formulate proper recommendations for rectifying the defects in premises

5. Conduct and produce a technical report which can be used in assessing the state of repair and hygiene of a premises for issuance of trading licences
6. Abating private, public and statutory nuisances in accordance of Public Health Act Cap 295
7. Collect food and water samples from premises for analysis
8. Conduct effectively occupational health risk assessment

COURSE CONTENT

Theoretical Inspections of Premises and Reporting

1.0 Inspection and reporting procedures

1.1.1 Professional ethics and code of conduct

1.1.2 Legislation regarding power of entry; behaviour, language and interpersonal skills; methodology and practice; data collection and presentation; formatting written communication; formal reporting; interdisciplinary connotations and remedial procedures

1.2. Food storage, manufacturing, preparation (including taverns)

1.2.2 Definitions; siting; construction; amenities; services; maintenance and structural condition; staff hygiene; food handling and storage

1.3 Hotels and guesthouses

1.3.1 Planning approval; Food handling and preparation standards; bedrooms, furniture and beddings; sanitary accommodation and water supply

1.4 Swimming Pools

1.4.1 **Health risks and safety:** Diseases associated with swimming pools, hazards, safety rules, security, supervision

1.4.2 **Water treatment:** Sources, filtration, sterilization, chemical adjustment, chlorine and pH level, clarity

1.4.3 **Ancillary facilities:** Sanitary accommodation, change rooms, showers, footbaths, drainage, water supply and testing equipment.

1.4.4 **Layout and designs of pools**

1.4.5 **Management:** Safety rules, qualified supervision, safety equipment, records of water monitoring

1.5 Public Buildings

1.5.1 **Definitions:** Cinemas, theatres, conference centres and open grounds

1.5.2 **Buildings:** Design, construction and maintenance

1.5.3 **Sanitary accommodation**-Types, adequacy and maintenance

1.5.4 **Water supply:** Adequacy and safety

1.5.5 **Exits:** Adequacy, emergency exits and operation

1.5.6 **Lighting and Ventilation:** Suitability and sufficiency

1.5.7 **Catering facility:** Food hygiene standards compliance

1.6 Schools and Crèches

1.6.1 **Siting:** Location and orientation

1.6.2 **Buildings:** Design, construction and maintenance

1.6.3 **Space:** No of children, size of classrooms, dimensions of classrooms

1.6.4 **Lighting and ventilation:** Fenestration, and general suitability and sufficiency

1.6.5 **Water supply:** Suitability and sufficiency

1.6.6 **Toilet facilities:** Sufficiency for number of children and staff, suitability and maintenance

1.6.7 **Canteen:** Conformity with food hygiene standards

1.6.8 Play grounds and open areas

1.6.9 **Hazards:** Safety procedures and first aid

1.7 Factories and Workplaces

1.7.1 Siting: Town planning and zoning compliance

1.7.2 Buildings: Design, construction and maintenance

1.7.3 Hygiene: Lighting, ventilation, extraction of dust, fumes, odour

1.7.4 Amenities: Sanitary accommodation, ablutions, canteen, changing rooms

1.7.5 Toxic material: Use, storage, disposal of waste and containers

1.7.6 Occupational health and safety issues

1.8 Offensive trades

1.8.1 Defining of offensive trades

1.8.2 **List, and describe the characteristics of offensive trades and their processes:** Blood boiler or drier; bone boiler, fat extractor or fat melter; fellmonger, hide–factor, hide-dealer and skin drier; tanner; soap boiler, tallow-melter, candle-maker and fat-melter; tripe and chitterlings; gut cleaner or scraper; knackery; rag and bone dealer; manure manufacture; breeder of maggots; cat gut; fish frying; pet shops and hygienic operation of offensive premises

1.8.3 **Town planning:** Siting of defined offensive trades zones in relation to other developments

1.8.4 **Construction of offensive trade premises:** Floor, walls, ceiling, ventilation, lighting, vermin control, furniture and fixture, containers, water supply, drainage, refuse, plant and personnel

1.8.5 **Treatment of fumes, odour control and counteractions:** Combustion and catalytic oxidation, wet scrubbing or absorption by water, dry scrubbing, ultraviolet irradiation and ionisation, masking, discharge of gases at a safe height, electrostatic precipitation, odour counteraction

1.8.6 W**aste disposal:** Control of air-borne and other effluents and waste disposal facilities

1.8.7 **Prevention of nuisances:** Air-borne, particulate debris, insect and rodent control

1.9 Caravan and Campsites

1.9.1 **Location:** General siting suitability

1.9.2 **Layout:** Design and spacing of layout and access

1.9.3 **Surface drainage:** Adequate to prevent ponding and flooding

1.9.4 **Amenities:** Showers, sanitary accommodation, adequacy and suitability

1.9.5 **Waste disposal:** Provision of storage, collection and disposal

1.9.6 **Management:** Discipline of hygiene management and accident prevention

1.10 Construction Camps

1.9.7 **Siting:** General suitability including traffic hazards

1.9.8 **Structures:** Safety and suitability

1.9.9 **Amenities:** Water supply, power, ablution and sanitary accommodation

1.9.10 **Waste disposal:** Provision for storage, collection and disposal arrangements for both solid and liquid wastes

1.9.11 **Management:** Discipline of hygiene management and accident prevention**.**

2. Practical Inspection of Premises and Reporting

2.1 Common appropriate technical words and phrases used in reports

2.2 Methods of identifying faults or defects in dwellings, workplaces and recreation buildings

2.3 Technical language used in the reports

2.4 Techniques in note taking, formulating the report and sketching

2.5 Procedure of conducting practical inspection and production of a complete report of each of the following premises: bakery, restaurant, butchery, hotel, school or nursery, market, factory and any public building

TEACHING METHODS

1. Lectures
2. Practical
3. Assignments
4. Tutorials

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Hannu. K. Janne. L. (2014). **Meat Inspection and Control in the Slaughterhouse**. NewYork: John Wiley and Sons Inc.
2. Dr. Ashraf. M., Dr. Ghaoutic. C. et al. (2014). **Slaughterhouse inspection (Egypt).** 1st ed. Wageningen: Center of development innovation

RECOMMENDED READINGS

1. GRZ (2019). **Food Safety Act No. 7 of 2019.** Lusaka: Government Printers.
2. Bassett, H. W. (1995).**Clay's Handbook of Environmental Health.** London: Chapman & Hall

YEAR FOUR SEMESTER ONE

EHS 411	Principles of Occupational Health and Safety
EHS 412	Epidemiology
EHS 413	Food Safety and Food Inspections
EHS 414	Integrated Disease Surveillance and Port Health
EHS 415	Biostatistics
EHS 416	Practical Training II

COURSE TITLE: PRINCIPLES OF OCCUPATIONAL HEALTH AND SAFETY
COURSE CODE: EHS 411

INTRODUCTION

Occupational Health is a multidisciplinary activity, which seeks to protect and promote the health of workers by preventing and controlling occupational diseases and accidents.

Occupational Hygiene and Ergonomics enhance one's ability to anticipate, recognize, rationally evaluate the risk and control the health hazards in a working environment

COURSE AIM

To provide an understanding of Occupational Health and Safety, embracing concepts of Occupational Hygiene and Ergonomics

COURSE OBJECTIVES

1. Describe the principles of occupational health and safety
2. Describe the concepts occupational hygiene and ergonomics
3. Outline health effects that result from particular tasks
4. Understand toxicological effects of environmental harmful chemicals and toxins
5. Interpret international threshold limit values
6. Assess adequacy of ventilation systems and their application
7. Explain illumination requirements for industry
8. Identify radiation hazards and their control

COURSE LEARNING OUTCOMES

1. Use varying hazard recognition techniques
2. Identify the range of health hazards encountered in the workplace
3. Identify sources and potential routes of exposure
4. Utilize international guidelines in managing Occupational health and Safety
5. Manage occupational hygiene programmes
6. Manage safe working systems
7. Influence workplace designs

COURSE CONTENT

1.0 General principles of occupational health and safety

1.1. Historical background
1.2. Scope, aim and objectives
1.3. Introduction to industrial set-up, structure and function of industry
1.4. Overview of occupational health services
1.5. Industrial labour policies
1.6. Government organisation
1.7. ILO convention and recommendations
1.8. International standards
1.9. Occupational health information - including library facilities and Internet.
1.10. Applied physiology in occupational health and safety
    1.10.1 Body temperature regulation
    1.10.2 Indices of heat stress

2.0 Factors in heat tolerance

1.2 Measurements of thermal environment
2.2 Health effects of climatically factors

3.0 Occupational Hygiene

3.1 General principles of occupational hygiene

3.2 Classification of occupational hazards: Chemical hazards; biological hazards; physical hazards; psychosocial hazards; stress and hypertension; heavy metals (lead, mercury, uranium) and non-metals

3.3 Hazardous dusts: Definition, particle size, form and structural properties, physical characteristics, terminal settling velocity (Stroke's law), Brownian movement and diffusion, electrostatic forces, flocculation of dust particles, impingement of dust particles; deposition of inhaled dust and health effects

4.0 Toxicology and Chemical Safety

4.1 General principles of toxicology Origin and scope of toxicology;

4.1.1 Dose response relationship
4.1.2 Routes of exposure; absorption; distribution and excretion of toxicants
4.1.3 Bio-transformation of toxic substances and factors influencing toxicology

4.2 Classification of hazardous substances

4.2.1 Physical, chemical, biological and physiological classification

4.2.3 Pesticides and persistent organic pollutants (POPs)
[Aldrin, Chlordane, Dichlorodiphenyltrichloroethane (DDT), Dieldrin, Endrin, Heptachlor, Hexachlorobenzene (BHC), Merer, Toxaphene, Dioxin, Furan and Polychlorinated biphenyl (PCB)]

4.2.4 Industrial solvents
4.2.5 Metals
4.2.6 Food-borne toxicants; toxins of animal origin
4.2.7 Phytotoxins and social toxins

4.3 Health effects of toxins: Acute, chronic, cancer, mutations, birth effects, and reproductive toxicity

5.0 **Principles of controlling chemical hazards**
5.1 Introduction
5.2 Elimination: Hazards process or specific hazards process
5.3 Stopping production
5.4 Substitution: Process, equipment, materials
5.5 Isolation: Process, Material, Worker
5.6 Enclosure: Process, machinery
5.7 Ventilation: Local exhausts and supply
5.8 General exhaust and supply
5.9 Personal and general hygiene
5.10 Personal protection General philosophy
5.11 Protection against inhalation of hazards
5.12 General principles of assessing chemical hazards (dust, gases, vapours and control devices)
5.13 Safety programme for industry (education, managers, engineers, supervisors, workers)

6.0 Threshold Limit Values
6.1 Definition of threshold limits values (TLV)
6.2 Documentation of TLV (Guidelines made by American Conference of Government Industrial Hygiene – ACGIH)
6.3 Time weighted average threshold limits (TWA – TLV)
6.4 Short term exposure limits (STEL – TLV), definition and use
6.5 Threshold limit value for mixture
6.6 Biological threshold limit value
6.7 Environmental threshold limit values

7.0 Principles of industrial ventilation
7.1 Introduction
7.2 Classification of ventilation systems
7.3 Particles of airborne materials

7.4 Application of dilution ventilation
7.5 Make-up air (Replacement of air)
7.6 Air moving devices (fans and selection)
7.7 Equipment for measuring airflow
7.8 Maintenance of air conditioning system

8.0 Industrial illumination
8.1 Introduction
8.2 Lighting terminology (Intensity, lux, illumination level, luminance, reflectance, light fittings)
8.3 Purpose of lighting -lighting for task performance
8.4 Illumination requirements for industry
8.5 Industrial lighting equipment
8.6 Lighting design
8.7 Lighting surveys
8.8 National and international standards

9.0 **Radiation**
9.1 Introduction to non- ionising radiation
9.2 Ultraviolet radiation (UV)
9.3 Laser radiation
9.4 Microwave radiation
9.5 Hazard identification and control
9.6 Introduction to ionising radiation
9.7 Quantities and units
9.8 Categories of radiation exposure
9.9 Biological aspects of radiation
9.10 Radiation protection
9.11 Occupational
9.13 National and international standards

10 Ergonomics and biomechanics
10.1 The anatomy of function
10.2 Anthropometrical
10.3 Work tolerance
10.4 Manual handling
10.6 Work positions
10.7 Repetitive work
10.8 Ergonomic and biomechanical evaluation
10.9 National and international standards

11 Noise hazards and control
11.1 Definition of sound and noise and basic terminology

11.2 Physiology of hearing
11.3 Sound levels of some noise sources found in different environments
11.4 Combination of sound sources
11.5 Perception of noise
11.6 Health effects of noise
11.7 Noise measurement and acceptability criteria
11.8 Noise control: Plant planning, substitution, modification, and personal protection)
11.9 National and international standards

12 Vibration hazards and control

12.1 Introduction to vibration
12.2 Characteristics of vibrations
12.3 Health effects of vibration
12.4 Industries affected
12.5 Exposure criteria
12.6 Measurement
12.7 Control
12.8 National and international standards

13 Case studies

13.1 Carryout case study in any of the following areas: -
13.2 Comprehensive risk assessment on a chosen workshop, process or industry
13.3 Sampling strategy: Draw up a realistic sampling strategy or program and draw sampling procedure for two of the hazards or stresses
13.4 Device a practical occupational health and safety management system for an organisation. This should include steps to control the hazards or stresses

TEACHING METHODS

1. Lectures
2. Group Discussions
3. Practical
4. Demonstrations and Fieldwork
5. Individual student presentations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours per week
4. Laboratory work: 1 hour per week
5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.2.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Mansdorf S. (2019). Occupational Health and Safety. 3rd ed. New York: John Wily and Sons publishers.
2. Ferrett. E., Phil. H (2012). Introduction to International Health and Safety at Work. 2nd ed. New York: Routledge

RECOMMENDED READINGS

1. GRZ. (2010). **Occupational Health and Safety Act No.36 of the Laws of Zambia**. Lusaka: Government Printers
2. GRZ. (1966). **Factories Act No.2 of the Laws of Zambia**. Lusaka: Government Printers
3. ILO. (1999). **International labour standards concerned with labour inspection main provisions**. Geneva. ISBN 92 – 2 – 106753 – X and ISBN 92 – 2 306753 – X

COURSE TITLE: EPIDEMIOLOGY
COURSE CODE: EHS 412

INTRODUCTION

The course is designed to prepare students with appropriate knowledge and skills in epidemiology principles, concepts, and procedures useful in the surveillance and investigation of health-related events that will be used for directing public health action.

COURSE AIM

To provide a solid foundation for the students to apply epidemiological approaches in the planning and evaluating strategies to prevent illness and apply epidemiological principles in understanding disease patterns

COURSE OBJECTIVES

1. Describe principles of epidemiology and their relevance in the control of diseases 2. Calculate and present epidemiologic data
3. Synthesize and interpret study results.
4. Analyze quantitative and qualitative data using frequency tables and graph
5. Carry out basic epidemiological analytical skills

COURSE LEARNING OUTCOMES

1. Describe principles of epidemiology and their relevance in the control of diseases
2. Calculate epidemiologic data in order to synthesize and interpret study results
3. Develops a population - based perspective of disease and other health relate events
4. Conducts epidemiological research for directing public health action
5. Applies descriptive and analytic epidemiology
6. Calculates and interpret ratios, proportions, incidence rates, mortality rates, prevalence, and present epidemiologic data
7. Uses tables, graphs, and charts to organize, summarize, and display data
8. Conducts an outbreak investigation
9. Analyses public health surveillance results for directing public health action

COURSE CONTENT

1.0 Introduction

1.1 Definition of epidemiology

1.2 Types of epidemiology

1.2.1 **Descriptive epidemiology:** Person, Time and Place; Counts, ratios, proportions and rates; Incidence measures; and Prevalence measures

1.2.3 **Analytic epidemiology:** Hypothesis formulation in epidemiologic studies; Measures of effect (odds ratio, risk ratio, etc); and Statistical parameters in epidemiologic studies.

2.0 **Evaluating associations:**

2.1 Concepts of statistical associations;

2.2 Chance;

2.3 bias and confounding;

2.4 Validity

3.0 **Types of study designs:**

3.1 Cross sectional studies;

3.2 Cohort studies; 3

3.3 Case control studies; and

3.4 Experimental studies.

4.0 **Infectious disease epidemiology:**

4.1 Definitions used in infectious disease epidemiology;

4.2 Disease transmission and its dynamics; and

4.3 Outbreak investigation

5.0 **Measures of public health importance:**

5.1 Attributable risk;

5.2 risk; and

5.3 Disease prevention and control

6.0 **Screening:**

6.1 Characteristics of diseases appropriate for screening;

6.2 Role of screening in the secondary prevention of disease;

6.3 Measures of the validity of a screening test (sensitivity and specificity).

7.0 Field investigations: epidemiology in action

8.0 Surveillance

9.0 Student project and report writing

TEACHING METHODS

1. Lectures
2. Tutorials
3. Practical
4. Group discussions
5. Presentations

NOTIONAL HOURS: 70 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 **Continuous assessment 40%**
1.1 1 Test 20%
1.2 1 Assignments 10%
1.3 Computer Lab test 10%

2.0 Final Examinations 60%
2.1Theory 40%
2.2 Computer lab exam 20%

PRESCRIBED READING

1. Anna W. Stephen G. (2011). **Clinical Biostatistics and Epidemiology Made Ridiculously Simple**. 1st ed. Miami; Medmaster Inc
2. Rothman, K. J. (2002). **Epidemiology: An introduction.** London: Oxford University press

RECOMMENDED BOOKS

3. Brownson, R. C. and Petitti (2006). **Applied Epidemiology- theory to practice**. London: Oxford university press.
4. Gordis, L. (2009). **Epidemiology**. 4th edition; ISBN 0-7216-5137-2

COURSE TITLE: FOOD SAFETY AND FOOD INSPECTIONS
COURSE CODE: EHS 413

INTRODUCTION

This course will introduce the principles of food hygiene and safety. It shall impart knowledge on food safety and control, food inspections and supportive enforcement measures that can contribute to food hygiene and safety. Furthermore a relation between the built environment, food hygiene and safety shall be emphasized, where knowledge of risk rating food premises shall be shared.

COURSE AIM

To produce an Environmental Health Practitioner who should advice on principles of food hygiene and safety practices, and enforce food laws.

COURSE OBJECTIVES

1. Identify the essential principles of food hygiene
2. Relate food hygiene to design of adequate infrastructure.
3. List principles of food hygiene
4. Describe different food additives
5. Elucidate food premises risk rating
6. Describe different types of food safety laws

COURSE LEARNING OUTCOMES

1. Implement food premises risk rating
2. Use HACCP (Hazard Analysis Critical Control Point) technique
3. Enforce food safety laws
4. Identify other foods
5. Manage food safety systems
6. Implement food premises risk rating
7. Enforce food safety laws
8. Identify various foods safety systems
9. Identify spices in foods level limits
10. Identify colours in foods level limits
11. Calculate risk rate in food premises

COURSE CONTENT

UNIT ONE: FOOD SCIENCE, MICROBIOLOGY AND FOOD CHEMISTRY

1.1 Food Science

1.1.1 Definition and uses of food science
1.1.2 Cellular basis of food (animal and plant)
1.1.3 Water activity and water migration: the basis for food preservation
1.1.4 The roles of enzymes in food production, processing and quality attributes
1.1.5 Enzymatic and non-enzymatic browning reactions, influences on colour, flavor and texture.
1.1.6 Meats; biological and chemical considerations

1.2 Food Microbiology

1.2.1 Definition of and use of food microbiology
1.2.2 Sources of food contaminants
1.2.3 Microbial growth in food
1.2.4 Intrinsic & extrinsic factors that influence microbial growth and multiplication
1.2.5 Food spoilage organisms
1.2.6 Indicator microorganisms
1.2.7 Foodborne pathogens
1.2.8 Microbiological standards of food
1.2.9 Aseptic food sampling techniques
1.2.10 Laboratory food analysis & reporting
1.2.11 Interpretation of microbiological results

1.3 Food Chemistry

1.3.1 Definition of and use of food chemistry
1.3.2 The roles of carbohydrates in food structure, colour, flavor and texture
1.3.3 The roles of lipids in food structure, colour, flavor and texture
1.3.4 The roles of proteins in food structure, colour, flavor and texture
1.3.5 Food additives and food labelling

UNIT TWO: FOOD SAFETY AND HYGIENE:

2.1 Introduction to food hygiene and food poisoning

2.1.1 **Introduction:** The importance of safe and wholesome food (Cost of illness, effect on manpower, danger of epidemics, effect on tourism); aesthetic considerations; and healthy eating

2.2 Food poisoning

2.2.1 Microbial agents and characteristics of organisms
2.2.2 Infection caused by microorganisms
2.2.3 Infection caused by agents other than microorganisms

- Animal toxins and parasitic infections,
- Poisoning by animals
- Reservoir of infection and ways of spread
- Food analysis and bacteriological

2.3 Chemical and metallic poisoning

2.3.1 Common chemicals and metals in food poisoning
2.3.2 Poisonous plants (certain mushrooms, plants and moulds such as aspergillus) and fish

- Mycotoxins
- Investigation of food poisoning outbreaks

2.4 Common food borne diseases

2.4.1 The etiology of diseases commonly caused by infected foods
2.4.2 Other illness associated with food

- Brucellosis, cryptosporidiosis, dysentery, gardiasis, hepatitis, listeriosis, typhoid and tuberculosis
- Bovine spongiform encephalopathy (BSE)
- Parasites affecting food and or man

2.4.3 Investigation into food borne illness: Extent of outbreak, questionnaire design, investigation techniques, record of symptoms and their severity, detail of foods and drinks consumed previously and with whom, samples of left over foods, specimen of stool and vomitus, collation of investigation results and interpretation of their probabilities

2.5 Principles for Food safety

2.5.1 Quality control and principles of Hazard Analysis Critical Control Point (HACCP)

- **Quality control:** Definition, principles of quality assurance and purpose of quality control programme, setting standards, adulteration of foods, external quality control activities, importance of food standards and legislation, sensory assessment of foods and analysis of results
- Quality assurance systems and Good Manufacturing Practice/Good Hygienic Practice (GMP/GHP)
- **Preparing for HACCP:** Management, personnel, training and prerequisites; baseline audit and gap analysis in relation to: time and temperature; cleaning and disinfection; personal hygiene; pest control and prevention of cross-contamination
- **Development of HACCP plan:** What is HACCP plan, describe the product and flow diagramme, critical control points, control limits, monitoring requirements and corrective actions
- **Implementation of HACCP:** Implementation requirements and team training, monitoring system, record keeping, facilities and equipment, confirmation and verification that implementation plan is complete
- **Maintaining HACCP plan:** Verification through audit, data analysis, keeping abreast of emerging hazards, updating and amending HACCP plan, ongoing training programs

2.6 Food Contamination and its Prevention

2.6.1 Contamination by micro-organisms

2.6.2 Vehicle and routs of bacterial contamination

2.6.3 Physical contamination; identification of hazards and control measures

6.6.4 Chemical contamination

2.7 The Storage and Temperature Control of food

2.7.1 Stock rotation; dry food stores; shelving, storage containers; chilled rooms, refrigerators and deep freezers

2.7.2 Storage of frozen food

2.7.3 Cook-chill

2.7.4 Safety of chilled foods

2.7.5 Cook-freeze

2.7.6 Vending machines

2.8 Food Spoilage and Preservation

2.8.1 Food spoilage and food preservation techniques with chemicals and their application to various foodstuffs

2.8.2 Food preservation with low-temperature

2.8.3 Food preservation with high-temperature

2.8.4 Chemical methods of food preservation

2.8.5 Physical methods of preservation e.g. by drying

2.8.6 Food preservation with radiation

2.8.7 Traditional methods

2.9 Personal Hygiene

2.9.1 Medical examination; training; protective clothing; hair covering; jewellery; gloves; first aid kit

2.9.2 Personal habits and hand washing

2.10 Food hygiene

2.10.1 **Food hygiene in the retail trade:** Delicatessen and cooked meat sales, bakeries, fresh meat sales, wet fish sales and produce sales

2.10.2 Misuse of insecticides and antibiotics

2.10.3 **Premises layout:** Handling of food materials, layout and integration of different materials

2.10.4 Staff selection, training, post appointment, exclusion of food handlers

2.10.5 **Design and Construction of Food Premises**

2.11.1 D**esign and construction** of p**remises**

- The siting, general design principles and structural techniques
- Construction of ceiling
- Walls and floors
- Lighting
- Ventilation and air conditioning
- Noise and vibration and maintenance

- Fittings and furnishings

2.12 Raw materials

2.12.1 Feedstock for the food industry
2.12.2 System for raw material hygiene audit
2.12.3 Raw materials as purchased product
2.12.4 Supplier assurance assessments and audit
2.12.5 Preventive corrective action and verification

2.13 Cleaning and Disinfection

2.13.1 Cleaning and disinfecting systems: Cleaning schedules**,** Cleaning products and methods, Proactive cleaning, Monitoring procedures, Safety and supply of chemicals, Water hygiene for cooling and Domestic water systems

2.13.2 Cleansing and sterilizing techniques: Soaps; detergents; washing creams; bactergents; scouring powders and pads; floor cleaners and polishers; and planned cleaning

2.14 Pest control

2.14.1 Pest and hazard control: Danger of rats, mice, cockroaches, fleas, ants, cats and birds and their breeding habits and control
2.14.2 Use of hazardous chemicals near food or use of unsuitable metals in contact with food
2.14.3 Dangers from broken glass, nuts and bolts or packaging materials in food

UNIT THREE: FOOD INSPECTIONS

3.1 Milk and milk products

3.1.1 **Introduction:** Diseases associated with milk, sources of bacterial infection and keeping quality
3.1.2 **Composition of milk and milk products:** Variations in composition, abnormalities in milk including characteristics of different breeds of cow
3.1.3 **Prevention of contamination:** Animal health, milking practice, cow sheds, dairies, milking pails, washing and sterilizing equipment, farm storage, delivery to milk factory, distribution, siting, construction and design of premises, equipment and fittings
3.1.4 **Heat treatment of milk:** Holder and High Temperature Short Time (HTST), pasteurisation, sterilisation, Ultra Heat Treatment (UHT), sterilization, uperisation, homogenisation, vacuum pasteurisation and irradiation
3.1.5 **Milking containers and packing:** Tankers, cans, bottles and bottling, tetra-packs, polythene bags and bottles, transportation and storage of packed milk
3.1.6 **Cleaning and sterilization of utensils and equipment**
3.1.7 **Testing and grading of milk:**Olefactory, methylene blue, resazurin, clot on boiling, acidity, sedimentation, colony counts, microscope count, coliforms, pathogenic organisms, cell counts, specific gravity, Gerber and Babock tests, creamometer, gravimeter, Hortvet, phosphatase and turbidity tests

3.1.8 **Milk products:** Methods of manufacture, ingredients, nutritive value, defects, liability to carry infection, inspection and sampling of;

- Separated milk, cream, clotted cream, canned cream, whey, cheese, butter, ghee, buttermilk, fermented milk (yogurt), dried milk, evaporated and condensed milk, infant foods, reconstituted milk, ice cream, water ices and ice
- Layout and construction of factories and other premises relating to the above including equipment
- Manufacture of margarine and vegetable oil

3.2 Poultry, aquatic and other animals

3.2.1 **Poultry:** Anatomy and physiology, killing, dressing and packaging, diseases of poultry (fowl typhoid, salmonellosis, tuberculosis, bird influenza, pasteurellosis, newcastle and coccidiosis), inspection of poultry and slaughtering premises including game birds

3.2.2 **Eggs:** Composition and nutritive value (freshness and soundness including salmonellosis)

3.2.3 **Rabbits and hares:** Differential diagnosis of anatomy and physiology, common diseases and inspection

3.2.4 **Game meat inspection:** Diseases of game animals and inspection; game cropping

3.2.5 **Fish and shellfish crustaceans:** Anatomy and physiology, preservation, storage, transportation of fresh and frozen fish, retailing premises and inspection. Safety of fish and shellfish.

3.2.6 **Meat and meat products:**

- The significance of meat (beef, mutton, pork, poultry and game animals) in food control, their diseases and conditions dangerous to health; the importance of preventing cross contamination between raw and ready to eat foods

3.3 Food processing

3.3.1 **Equipment:** Used for various food processes

3.3.2 **Technologies used in food processing:** Brewing, milling, meat processing and meat products, confectionaries, tea and coffee production, bakery products and non-alcoholic beverages

3.4 Food Hygiene and Inspection

3.4.1 **Staff facilities:** Cloakrooms; change rooms; toilet accommodation; washing facilities; and canteen

3.4.2 **Primary food sources:** Farming practices; use of insecticides and other agrochemicals on foods; use of antibiotics and hormones on livestock; farm dairies and milking techniques; temperature control; safe transportation of foods; raw meat its inspection and prevention of cross contamination

3.4.3 **Nutritional value of foods:** Dietary requirements; nutritional values; preservation of nutritional values during harvesting, transportation, storage, preparation and cooking

3.4.4 **Premises inspection:** Field visits and compilation of reports on food premises including restaurant and hotel kitchens (With particular reference to international tourist hotels, hospitals and uplift meal kitchens for international aircraft), dairies,

supermarkets, delicatessens, bakeries and confectioners, breweries, soft drink manufacturers, millers, grocers, greengrocers, caterers, outdoor catering, food stalls and markets, meat processing plants

3.4.5 **Training and education:** Programming courses for food handlers training; health education for the general public; the implementation and application of HACCP and other standards

3.5 Inspection of other foods

3.5.1 Meat products
3.5.2 Vegetables and fruits
3.5.3 Milk and milk products (composition, prevention of contamination, preservation, container and packaging)
3.5.4 Cereals and cereal products
3.5.5 Alcoholic, non-alcoholic beverages
3.5.6 Spices and herbs
3.5.7 Sauces and pickles
3.5.8 Condiments
3.5.9 Dried fruits and nuts
3.5.10 Confectionary
3.5.11 Food additives

3.6 Food Safety Law and International Standards

3.6.1 Food Safety Act No. 7 of 2019 of the laws of Zambia
3.6.2 Public Health Act Cap 295 and Regulations made there under
3.6.3 Local Food laws – Bye laws
3.6.4 International Food Laws and Standards e.g. Codex, EU, FDA
3.6.5 Prosecution Procedures

3.7 Practical Food Inspection

3.7.1 Conduct inspections on food premises and report on: Food markets; hotels; restaurants; dairies; bakeries; butcheries; cold rooms; tearooms; food processing plants; abattoir; bars and taverns
3.7.2 Visit to dairy farms, milk and milk product processing plants, dairy laboratory, milk shops and ice cream shops
3.7.3 Participate in the disposal of condemned foodstuff
3.7.4 Draw foodstuff samples and interpret results for bacteriological and chemical analysis 3.7.5 Identify diseases or types of defects on each of the following: Poultry, eggs, fish, game meat, canned foodstuff, cereals and vegetables
3.7.6 Investigate and report on complaints related to food

TEACHING METHODS:

1. Lectures
2. Group Discussions
3. Tutorials

4. Field demonstrations
5. Presentations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 2 hours per week
3. Seminar: 2 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Mortarjemi Y, Huub L. (2013). **Food Safety Management: A Practical Guide for the Food Industry**. 2nd ed. London: Academic Press
2. Alok. K (2019). **Fundamentals of Food Hygiene, Safety and Quality**. 1st ed. New Delhi: IK
   International Publishing House
3. Sunkanta M., Ramlakhan S. (2019). **Food Safety and Human Health**. 1st ed. London: Academic Press
4. GRZ. (2014). **Food Safety Act No. 7 of 2019 of the Laws of Zambia**. Lusaka: Government Printers.

RECOMMENDED READINGS

1. Adrian C. (2017). **The Food Safety Pillars and Introduction to Food Safety and Hygiene**. 2nd ed. UK: Independently published.
2. Norman G., Moreoh M., et al (2018) **Principles of Food Sanitation.** 6th ed. New York: Springer
3. Sprenger, R. A. (2007). **Hygiene for management: A text for food hygiene courses.** 13th Edition. Highfield Co. publications Ltd. UK. ISBN 1 871912 660

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COURSE TITLE: INTEGRATED DISEASE SURVEILLANCE AND PORT HEALTH
COURSE CODE: EHS 414

INTRODUCTION

The course is designed to provide epidemiological information by which the spread of disease is monitored in order to establish patterns of progression. A key part of modern disease surveillance is the practice of disease case reporting, the skill that students shall be exposed to during training which will later be applied not only in communities but also at ports (harbours), border crossings and airports. The main role of disease surveillance is to predict, observe, and minimize the harm caused by outbreak, epidemic, and pandemic situations, as well as increase knowledge about which factors contribute to such circumstances.

COURSE AIM

The course is aimed at providing knowledge, skills and attitude to enable students conduct disease surveillance from which they will get epidemiological data that will help them manage outbreaks of diseases and plan for future scenarios through formation of Epidemic and Pandemic Alert and Response (EPR) teams mandated to detect, verify rapidly and respond appropriately to epidemic prone and emerging disease threats.

The course is further aimed at providing students with necessary public health capacities at ports, airports and ground crossings to limit the spread of public health risks, while at the same time minimizing any unnecessary interference with travel and trade in line with IHR commitments

COURSE OBJECTIVES

1. Explain the process of integrated disease surveillance and response
2. Describe types of epidemics
3. Outline organisational framework during an epidemic
4. Describe types of disasters
5. Outline organisational framework for disaster management
6. Describe the stages of disaster management
7. Explain the purpose and scope of IHR related to Port Health
8. Outline the role of Port Health in combating notifiable diseases at international level

COURSE LEARNING OUTCOMES

1. Identify cases and events of public Health importance
2. Report suspected cases or conditions or events of public Health importance
3. Analyze and interpret data on priority diseases and events
4. Investigate and confirm suspected cases, outbreaks or events
5. Monitor Integrated Disease Surveillance and Response implementation.
6. Monitor and evaluate Integrated Disease Surveillance and Response implementation

COURSE CONTENT

1. Integrated Disease Surveillance and Response

1.1 Definition of key concepts (disease surveillance, and integrated disease surveillance and response

1.2 Objectives of integrated disease surveillance and response

1.3 Integrated Disease Surveillance and Response and International Health Regulations

1.4 Priority diseases for integrated disease surveillance and response

1.5 Definition and types of epidemics: progressive epidemic; endemicity; and pandemic 1.6 Common sources of epidemics: point common-source: continuous common-source: and intermittent common-source

1.7 Epidemic preparedness: early warning; early detection; notification; verification; early response; post epidemic assessment; and preparedness plan of action.

1.8 Identification of cases of priority diseases, conditions, and events

1.9 Reporting priority diseases, conditions and events

1.10 Analysing disease surveillance data

1.11 Investigating suspected outbreaks and other public health events

1.12 Preparing to respond to outbreaks and other public health events

1.13 Organizational framework of epidemic preparedness:

1.13.1 National Epidemic Preparedness and Prevention Committee and responsibilities

1.13.2 Provincial Epidemic and Prevention Committee and responsibilities

1.13.3 District Epidemic and Prevention Committee and responsibilities

1.13.4 Satellite Epidemic and Prevention Committee and responsibilities

1.14 Responding to outbreaks and other public health events

1.15 Communicating information during integrated disease surveillance and response

1.15 Monitoring, evaluating and improving disease surveillance and response

2.0 Port Health

2.1 Definitions of key concepts used in port health: affected; contamination; conveyance; decontamination; deratting; disinfection; disinsection; free pratique; health measure; point of entry port; and quarantine.

1.3 Purpose and scope of International Health Regulations

2.3 Public health measures at point of entry

2.3.1 Health measures on arrival and departure

2.3.2 Special provisions for conveyances and conveyance operators

2.3.3 Special provisions for travellers

2.3.4 Special provisions for goods, containers and container loading areas

2.4 Health documents required at designated airports, ports and ground crossings

2.4.1 Certificates of vaccination or other prophylaxis

2.4.2 Maritime Declaration of Health

2.4.3 Health Part of the Aircraft General Declaration

2.4.4 Ship sanitation certificates

2.5 Port health procedures

2.5.1 Inspection of: airports, aircraft, dock premises and ships

2.5.2 Control of vermin and vectors in aircrafts, marine vessels and vehicles

2.6 International Health Regulations

TEACHING METHODS

1. Lectures
2. Field trips
3. Group discussions
4. Practical
5. Presentations

NOTIONAL HOURS: 100 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 2 hours per week
4. Seminar: 1 hour per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. **WHO International Health Regulations**. 2005. Geneva: WHO Press.
2. World Health Organization and Centers for Disease Control and Prevention (2010). **Technical Guidelines for Integrated Disease Surveillance and Response in the African Region**. Brazzaville: WHO Press.
3. Nkuchia M., Ruth L. et al. (2013). **Infectious Disease Surveillance**. 2nd ed. New York: Willy and Sons Publishers.

RECOMMENDED READINGS

1. John K., Nkuchia M. (2014). **Concepts and methods in infectious disease surveillance**. 1st ed. New York: Willey Blackwell
2. Scott J., Mark C., et al (2016). **Transforming Public Health.** 1st ed. London: Elsevier press

3. World Health Organization (2005**). Communicable disease control in emergencies: A field manual**. Geneva: WHO Press.

COURSE TITLE: BIOSTATISTICS
COURSE CODE: EHS 415

INTRODUCTION
The course is designed to prepare students with appropriate knowledge and skills on basic biostatistics that will be applied in research also for directing public health action.

COURSE AIM
To provide a solid foundation for the students to apply biostatistical approaches in research and for planning and evaluating strategies to prevent illness

COURSE OBJECTIVES
1. Apply biostatistical concepts and tools critical in biomedical (environmental health) evaluation
2. Describe practical application of statistical models of probability that are commonly used in sampling distributions.
3. Demonstrate knowledge of how to summarize data and use statistical methods.
4. Analyse quantitative and qualitative data using frequency tables and graph

COURSE LEARNING OUTCOMES
1. Formulate research question
2. Formulate hypothesis.
3. Summarize data and use statistical methods.
4. Analyse quantitative and qualitative data using frequency tables and graph
5. Carry out basic biostatistical and analytical skills5. Uses tables, graphs, and charts to organize, summarize, and display data
6. Demonstrate the use of computer packages e.g. EPI-INFO, SPSS, and/or STATA in the application of the different statistical methods taught
7. Summarise and present quantitative data using frequency tables and graphs

COURSE CONTENT

1.0 **Biostatics**
1.1 Introduction to Biostatistics
1.2 Scales of measurements
1.3 Sources and presentation of data
1.4 Measures of Location-Averages and Percentiles
1.5 Variability and its Measures
1.6 Normal Distribution and Normal curve.
1.7 Sampling procedures
1.8 Probability
1.9 Hypotheses formulation and hypothesis testing (Parametric and Non-Parametric Tests of Hypotheses)
1.10 Sampling variability and Significance
1.11 Significance of difference in Means.
1.12 Significance of Difference in Proportions of large Sample
1.13 The Chi-square Test
1.14 Analysis of Variance and Covariance
1.15 Multivariate Analysis Techniques
1.16 Correlation and Regression
1.17 Designing and Methodology of an Experiment or a Study
1.18 Demography and Vital statistics
1.19 Measures of Population and Vital Statistics
1.20 Life Table.

2.0 **The Computer: Its Role in Research**
2.1 The Computer and Computer Technology
2.2 Computer Applications
2.3 Computers and Researcher
2.4 Commercial statistical package
2.5 Practical Analysis in Computer lab

3.0 **Practical demonstration on the use of statistical software**
3.1 SPSS (Statistical Package for Social Sciences)
3.2 NVivo
3.3 R (R Foundation for Statistical Computing)
3.4 MS Excel (Microsoft Excel)
3.5 SAS (Statistical Analysis Software)
3.6 Epi Info. (Epidemiological Information)

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Presentations

NOTIONAL HOURS: 120 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 2 hours per week
4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 **Continuous assessment**	**40%**
1.1 2 Test	20%
1.2 1 Assignments	10%
1.3 Computer Lab test	10%

1.0 **Final Examinations**	**60%**
1.1 Theory	40%
1.2 Computer lab test	20%

PRESCRIBED READING

1. Anna W. Stephen G. (2011). **Clinical Biostatistics and Epidemiology Made Ridiculously Simple**. 1st ed. Miami; Med master Inc
2. Miller, J., Notz, W.I. (2010). **Statistics: Concepts and Controversies**. 7th ed. New York: W.H. Freeman and Company.

RECOMMENDED BOOKS

1. Daniel, W. W. (1991). **Biostatistics foundation for analysis in the health sciences.** New York: John Wiley and Sons, ISBN 0-471-52514-6

COURSE TITLE: PRACTICAL TRAINING II
COURSE CODE: EHS 416

INTRODUCTION
Students will be attached to Local Authorities for practice. The course provides students opportunity to undertake practical experience in various activities that are within the jurisdiction of Local Authorities under the Public Health Department.

COURSE AIM
The course provides students opportunity to undertake practical experience in various public health activities in Local Authorities.

COURSE OBJECTIVES
1. Develop the capacity to work effectively with related professional groups.
2. Expose students to industrial processes that falls within five pillars of environmental health training and practice
3. Attain practical competences in the fields highlighted in the practical Log Book
4. Produce a well written report which reveals the hazards in that industry with appropriate control measures

COURSE LEARNING OUTCOMES
1. Develop ability of working effectively with other related professionals
2. Appropriate description of industrial processes
3. Appropriate identification of hazards in a workplace or premises
4. Appropriate production of a written report an industrial process

COURSE CONTENT

1.0 COMMUNITY HEALTH

1.1 Attend at least one full council meeting and at least one sub-committee.

1.2 Attend at least one planning/management meeting in the Public Health dept. of the Local Authority

1.3 Investigate at least four different types of potential nuisances or conditions prejudicial to health.

1.4 Recognize and understand at least four different pest infestations, two of which must involve different invertebrate pests e.g. wasps, cockroaches, pharaohs ants etc. and two of which must involve mammalian or avian pests e.g. rats, mice, bats, etc

1.5 Identify three potential epidemics of disease and implement control measures, monitor continued development and recurrence.

1.6 Demonstrate your knowledge of the procedures to be followed in dealing with premises and/or persons found to be in a filthy and/or verminous condition by documenting your involvement with at least one actual or suspected case

1.7 Demonstrate your involvement in the licensing and/or registration process by providing details of at least three cases, one of which must be a public entertainment licence, one must be relating to existing law. the third can be from any other aspect of the licensing or registration of premises, for example, body piercing, taxis, cinemas, hair salons, barbershop and schools.

2.0 FOOD SAFETY

2.1 Inspect one premises under Public Health (Meat, abattoir and butcheries) Regulations

2.2 Inspect one restaurant approved under the Food Safety Act

2.3 Inspect either (a) a dairy or (b) a daily products plant approved under the Public Health (Milk products) Regulations and Dairy and Dairy Produce Act Cap 230

2.4 Inspected at least one of each of the following types of premises: A food retailer (not being a butcher) selling a range of open foodstuffs; A restaurant, café or canteen; A takeaway facility (not being combined with 'eat in' premises), either static or mobile; a hotel kitchen rated 3-5 stars; bakery, confectionary, meat processing/canning and ice cream manufacturing; A thermal processing plant, e.g., one undertaking canning, aseptic packaging or pasteurization; and a milling plant.

2.5 Document your involvement with at least two cases of food not of the nature, or substance, or quality demanded or that is wrongly labelled

2.6 Carry out audits of two different premises, producing different types of food products where you have identified practices which could lead to food being produced not meeting the Public Health Act and Food Safety Act (or other appropriate legislation)

and show how you determined the most appropriate course of action to deal with those issues or how practical steps had been taken to prevent such breaches.

2.7 Investigate two cases of food poisoning and foodborne disease, of which at least one should have been an outbreak.

2.8 Inspect two butchers' shops that are the subject of butchers' shop licensing.

2.9 Investigate at least two food complaints

2.10 Inspect slaughter houses

2.11 Conduct meat inspection

3.0 **BUILT ENVIRONMENT**

3.1 Inspect two unplanned developments.

3.2 Inspect three properties with a view to determining fitness for habitation. At least one of the inspections must be in relation to a dwelling which is, or has been, deemed to be unfit for habitation

3.3 Conduct four investigations into different types of nuisances or conditions likely to be prejudicial to health

3.4 Document your involvement on area housing issues, be they block repair, renewal or generation areas, clearance sites or similar.

3.5 Document your involvement with at least two applications for planning consent at least one of which must involve the regulation of harmful effect upon the environment.

4.0 **WATER AND SANITATION**

4.1 Inspect various sources of rural water supplies

4.2 Inspect urban drinking water treatment plants

4.3 Conduct water quality surveillance

4.4 Participate in the construction of sanitary facilities

4.5 Inspect wastewater treatment plants

4.6 Inspect septic tanks and associated soakways

4.7 Inspect drainage works

4.8 Test drainages

5.0 OCCUPATIONAL HEALTH AND SAFETY

5.1 Inspect work places

5.2 Conduct occupational risk assessment

5.3 Conduct occupational hygiene assessments

6.0 SOLID WASTE MANAGEMENT

6.1 Inspect solid waste disposal sites

6.2 Participate in solid waste collection and transportation

6.3 Participate in operations at the solid waste disposal sites

6.4 Inspect health care facilities to ensure compliance to guidelines on health care waste management

7.0 POLLUTION CONTROL

7.1 Inspect premises dealing with chemicals and other toxic substances

7.2 Conduct wastewater quality monitoring

7.3 Interpret air quality monitoring results

7.4 Follow up complaints on nuisances and take appropriate action.

8.0 PRACTICAL DEMONSTRATION OF ENVIRONMENTAL HEALTH TOOLS AND EQUIPMENT

8.1 Spray pump for vector control

8.2 Food probe thermometers

8.3 Water quality testing kit

8.4 Sound level meter

8.5 Luxmeter

8.6 Personal dosimeter

8.7 Kata thermometer

8.8 Standing Scales

8.9 Salter Scales

8.10 Height Scales

8.11 Height measuring Tapes

8.12 Rodent traps

8.13 Waste water sampling equipment

8.14 Food sampling equipment

8.15 Health care waste treatment equipment

8.16 Meat inspection knives

TEACHING METHODS

1. Tutorials

2. Field visits

4. Demonstrations

5. Practical attachment to industry

6. Report writing

NOTIONAL HOURS: 80 HOURS

1. Tutorial (Presentations): 1 hour per week

2. Field work: 10 hours per week

3. Laboratory work: 1 hour per week

4. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Summative assessment: 100%

1.1 Presentation of the report to peers 10%
1.2 Written report 30%
1.3 Practical log book 60%

PRESCRIBED READINGS:

1. Bassett W.H. (2004). **Clay's Handbook of Environmental Health.** London: Spon Press.
2. Koren, H., Bisesi, M. (2003). **Handbook of Environmental Health: Biological, Chemical and Physical agents of Environmentally Related Disease**.Fourth Edition, Vol. 1. New York: Lewis Publishers

RECOMMENDED READINGS

1. Afubwa, S,O., and Mwanthi, A.M. (2014) **Environmental Health and Occupational Health and Safety.** Nairobi: Acrodile Publishing Ltd
2. Stewart, J. (2001). **Environmental Health and Hosing: Clay's Library of Health and the Environment.** Volume 1. London: Spon Press.
3. Fumkin, H. (2010). **Environmental Health: From Global to Local.** Second edition. San Francisco: John Wiley and Sons Ltd.

YEAR FOUR SEMESTER TWO

EHS 421	Meat Pathology and Meat Inspection
EHS 422	Occupational Hazards and Risk Analysis
EHS 423	Environmental Monitoring and Pollution Control
EHS 424	Research methods
EHS 425	Industrial Training

COURSE TITLE: MEAT PATHOLOGY AND MEAT INSPECTION
COURSE CODE: EHS 421

INTRODUCTION

The course is designed to equip students with knowledge and skills in practical meat inspection to enable them protect the consumer against illness transmissible to man by meat. To do students should be able to identify pathological conditions necessary to take necessary action during meat inspection. This fact arises from the background of protecting the consumer against illness transmissible to man by meat.

COURSE AIM

The course aims at providing knowledge and practical skills to enable students appropriately conduct meat inspection for human consumption and take appropriate action where necessary to uphold legal requirements.

COURSE OBJECTIVES

1. Describe the pathological conditions in animal carcasses
2. Identify meat and meat products which are unfit for human consumption
3. Describe the hygienic transportation and marketing of meat and meat products
4. Identify diseased meat to prevent the spread of animal diseases to man

COURSE LEARNING OUTCOMES

1. Conduct meat inspections
2. Identify pathological conditions in carcass
3. Diagnose pathological conditions in animal carcasses
4. Make appropriate judgement and recommend accordingly
5. Describe the ideal design and construction of a slaughter house

COURSE CONTENT

UNIT ONE: MEAT PATHOLOGY

1. Introduction

1.1 Public health and other hazards of eating diseased meat

2. Post-mortem inspection

1.1 Determination of age and sex
1.2 Signs of healthy and normal flesh of meat and organs
1.3 Substitution and differentiation of various carcasses
1.4 Sterilization of inspection equipment
1.5 Inspection of carcasses (Second and third schedule of Public Health Act; Meat, abattoir and butcheries Regulations)

1.6 Procedure upon discovery of abnormalities

3.0 Pathological conditions

3.1 State of nutrition, inflammatory conditions, odours, pigmentation, imperfect bleeding, suffocation, oedema, emphysema, degeneration and circulatory disturbances

3.2 Generalised systemic infections:

3.2.1 Catarrhal, Diptheric, Serous, Haemorrhagic, Fibrous and Suppurative inflammations

3.2.2 Acute, Chronic and Septic Specific Inflammations:- Endo-Carditis, Glossitis, Hepatitis,

3.2.3 Cirrhosis, Mastitis, Nephritis, Necrosis, Ostitis, Pericarditis, Peritonitis, Pleurisy, Pneumonia, Orchitis, Metritis, Arthritis, Gastritis and Cystitis

4.0 General systemic infections

4.1 Toxaemia

4.2 Bacteraemia and Septicaemia

4.3 Pyaemia, cloudy swelling and pathological fatty change

5.0 Circulatory conditions

5.1 Anaemia, Uraemia, Hydraemia, Leukaemia, Haemorrhages, Haemoglobinuria (Red Water Fever), Icterus, Infarcts, Embolism and Oedema

6.0 Bacterial, viral and fungal diseases

6.1 Bacteria diseases: Actinobaccillosis, Anthrax, Blackleg, Caseous Lymphadenitis, Gangrene, Glanders, Johnes Disease, Malignant Cattarh, Swine Erysipelas, Swine Fever, Heartwater fever, Tetanus, Tuberculosis and Contagious Bovine Pleuro-Pneumonia (CBPP)

6.2 Fungal diseases: Pneumonomycosis and Actinomycosis

6.3 Viral diseases: Foot and mouth disease, Rabies, Malignant catarrhal fever, Rinderpest and Rift valley fever

7.0 Parasitic diseases

7.1 Nematodes: Ascaris (roundworm infestation of stomach, intestines and lungs in sheep, cattle and pig), Onchocerciasis, Sarcocystis, Haemosporidia, Strongyles and Trichinosis

7.2 Trematodes: Fasciola hepatica and gigantica

7.3 Cestodes: Taeniapisiformis, T. hydatigena, T. ovis, T. multiceps, Echinococcusgranulosus, Cysticercustenuicollis and tapeworms of man – Taeniasolium and Taeniasaginata

7.4 Protozoa: Coccidian, Sarcosporidia, Haemosporidia, Red water fever, East coast fever, Anaplasmosis, Trypanosomiasis and Corridor disease

7.5 Rickettsia: Rickettsifumeti (Q fever)

7.6 Ectoparasites (external parasites): Hypodermabovis; Gesture ovis and tick family

8.0 Other conditions

8.1 Rickets

8.2 Tumours (malignant and benign)

UNIT TWO: MEAT INSPECTION

1.0 Ante-mortem inspection

1.1 Dullness; Lameness; uncoordinated movement; lockjaw, excitability, salivation; diarrhoea, forced respiration or cough; swellings; swollen udder; bloat; general signs of fever and rash on the skin of pigs

2.0 **Post-mortem inspection**

2.1 Determination of age and sex

2.2 Signs of healthy and normal flesh of meat and organs

2.3 Substitution and differentiation of various carcasses

2.4 Sterilization of inspection equipment

2.5 Inspection of carcasses (Second and third schedule of Public Health Act; Meat, abattoir and butcheries Regulations)

2.6 Inspection of the head and the viscera:

2.7 Procedure upon discovery of abnormalities

3.0 Physiological conditions

3.1 Abnormal colour, pigmentation and taste

3.2 Wounds, bruises, injuries and malformation

3.3 Fatigue and stress

3.4 High body temperature and pyrexia

3.5 Imperfect bleeding and hypostasis

3.6 Moribund and dead animals

3.7 Emergency slaughter

3.8 Immaturity, poorness and emaciation

3.9 Physiological fatty infiltration

3.10 Foetuses and stillborn carcasses

3.11 Extra-uterine pregnancies

3.12 Advanced pregnancy

3.13 Recent parturition and milk fever

3.14 Setting of carcass and its importance to quality and meat inspection(Rigor mortis)

3.15 Decomposition

4.0 Procurement of specimen

4.1 Methods of collection, storage and disposal of specimens

5.0 **Methods of disinfection and sterilization**

5.1 Equipment and buildings

6.0 **Inspector's judgement and action**

6.1 Cattle

6.2 Sheep and Goats
6.3 Pig

7.0 Practical

7.1 Laboratory sessions (Systemic anatomy) i.e. Use of Specimens and visits

8.0 Legal requirements

8.1 Public Health Act Cap 295 and Regulations made there under (Meat, abattoir and butchery regulations), Prevention of cruelty to animals and as an offensive trade

8.2 Stock Disease Control Act Cap 252 and Regulations made their under

8.3 Food Safety Act Cap 303 and Regulations made their under

8.4 Siting, planning and design of premises, hygienic maintenance and prevention of nuisance

TEACHING METHODS

1. Lectures
2. Individual student presentations
3. Practical

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours per week
4. Laboratory work: 1 hour per week
5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Philip. C., Victoria A., Melonie C. (2019)**. Introduction to Animal Vertrinary, Anatomy and Physiology**. 4th ed. London. CAP International.
2. Rowen D. Frandson. W. (2009). **Anatomy and Physiology of Farm Animals.** 7th ed. New York: Wiley Blackwell.

RECOMMENDED BOOKS

1. FAO (2019). Techinical Guidance Principles of Risk- Based Meat Inspection and Their Application. Rome: FAO

COURSE TITLE: OCCUPATIONAL HAZARDS AND RISK ANALYSIS
COURSE CODE: EHS 422

INTRODUCTION

Occupational diseases and accidents adversely affect human health. It is therefore, necessary to provide the students with the knowledge and skills used in accident prevention and investigations, disaster management and control of occupational disease. This course covers principles of accident prevention, principles of practical application of accident prevention, establishment of work procedures in a workplace, occupational hazards and preventive occupational medicine.

COURSE AIM

To provide students with knowledge and skills used in accident prevention, investigation, disaster management and control of occupational and diseases

COURSE OBJECTIVES

1. Identify potential accidents in a workplace
2. Analyse occurrence of accidents
3. Describe principles of accident prevention and investigation
4. Describe emergence response procedures and management
5. Plan emergence response procedures and management
6. Explain occupational diseases and their control measures
7. Describe occupational medical screening programmes.
8. Carry out detailed occupational and environmental risk assessments;
9. Provide skills in the use basic equipment in the assessment of risks

COURSE COMPETENCIES

1. Identify, evaluate and control occupational accidents and diseases
2. Enforce occupational and environmental health and safety laws
3. Provide advice on occupational health and safety
4. Conduct occupational medicine screening programmes
5. Perform detailed occupational and environmental risk assessments;
6. Be able to use appropriately basic occupational health equipment in the assessment of risks
7. Formulate appropriate management options arising from findings to remove, reduce or manage the risks.
8. Provide emergence response procedures and management

COURSE CONTENT

1.0 Occupational Accidents and Diseases

1.1 Occupational accident prevention and investigation

1.1.1 Introduction
1.1.2 Causes of accidents
1.1.3 Analysis and classification of accidents (by type, nature of injury, bodily location)
1.1.4 Types of accidents (serious accidents, minor accidents and near accidents)
1.1.5 Analysis of accidents (statistics, frequency and severity rates, presentation of data)
1.1.6 Factory design, construction and layout
1.1.7 Machine guarding
1.1.8 Good order and good housekeeping
1.1.9 Personal protection equipment (goggles, safety shoes, gloves, hard hats, aprons, face mask, and ear protection)
1.1.10 Use of safety colours, notices, signs and labels
1.1.11 The loss problem (death economic loss)
1.1.12 Investigation of accidents (procedure and reporting)
1.1.13 Management responsibilities

1.2 Practical application of accident prevention principles

1.2.1 Machinery safety
1.2.1 Electrical safety
1.1.3 Pressure unit's safety
1.2.4 Fire safety
1.2.5 Construction safety
1.2.6 Handling and safety storage of explosives
1.2.7 Major hazards and accidents control

1.3 Establishment of emergency response procedures in a work place

1.3.1 Introduction
1.3.2 Procedures to be followed in the event of an accident or emergency
1.3.3 The information to be given to emergency services
1.3.4 Identification of local organisation qualified to give First Aid Training
1.3.5 Explanation and discussion of occupational health issues

1.4 Occupational diseases and hazards

1.4.1 Occupational eye injuries and control
1.4.2 Occupational peripheral nerve damage
1.4.3 Occupational pulmonary diseases and control (Pneumoconiosis; silicosis, Asbestosis, Occupational bronchitis and emphysema, occupational asthma, byssinosis, extrinsic allergic alveolitis)

1.4.4 Zoonoses - Anthrax, brucellosis, rabies and leptospirosis
1.4.5 Occupational dermatosis and prevention
1.4.6 Personal hygiene, protective clothing and barrier creams
1.4.7 Relationship between employment and non-occupational diseases (HIV/AIDS),
1.4.8 Definition, causes, mode of infection, symptoms and myths of HIV/AIDS. Impact of HIV/AIDS on family, enterprise and development. Factors which impact on HIV/AIDS such as poverty and workplace hazards. Prevention, information, education and training. Precautions and first aid, Voluntary counselling, confidentiality, testing and investigations on discrimination

1.5 Preventive occupational medicine

1.5.1 Occupational health screening programmes
1.5.2 Determination of fitness to work
1.5.3 Biological monitoring
1.5.4 Medical screening
1.5.5 Disability assessment and workers compensation
1.5.6 Surveillance system for early detection of disease
1.5.7 Vaccination and immunisation
1.5.8 Care of special working groups (young, HIV/AIDS, handicapped, pregnant women)
1.5.9 Education and propaganda

1.6 Environmental Risk Assessment and Management

1.6.1 Definitions of concepts in risk management terminology
1.6.2 Sources of information
1.6.3 Benefits and costs of risk management

1.7 Overview of environmental risk assessment process

1.7.1 Problem formulation
1.7.2 Analysis- Sources, pathways, exposure features, Direct and indirect measures, Exposure modelling, dose response assessment, exposure assessment;
1.7.3 Risk characterization/classification- Risk ranking, populations at risk, qualitative and quantitative approaches
1.7.4 Risk communication- Reporting systems for fatalities, accidents and dangerous occurrences, stakeholder and public participation

1.8 Practical illustrations of risk and hazard analyses

1.8.1 Natural disasters
1.8.2 Fires
1.8.3 Explosions
1.8.4 Chemical leakages

1.9 Management Options

1.9.1 Best Available Technology (BAT)
1.9.2 Standard setting, Policy formulation and implementation
1.9.3 Voluntary Standards (e.g. ISO, HACCP)

1.10 Occupational Risk assessments and management

1.10.1 Management (principles, style, organization, roles and functions)
1.10.2 Risk Assessment
1.10.3 Organization of occupational health services
1.10.4 Compilation of occupational health records
1.10.5 Professional relationships with physicians, managers and workers
1.10.6 Skills in risk assessment (interdisciplinary approach, incident investigation, health and safety inspection and reports)
1.10.7 Occupational health and safety policy and policy formulation

1.11 Use of basic instruments for assessing risks

1.11.1 **Asbestos:** Study counting procedures and criteria for asbestos using optical microscopy of scanning electron microscopy
1.11.2 **Air sampling**: Man – made fibre, silica, lead, heavy metals, nuisance and femur aerosol, coal dust, oil mist and welding fumes
1.11.3 **Identification of types of filters and size of filters required for dust sampling:** Cellulose ester, nucleopores, silver membrane, glass fibre and polyvinyl
1.11.4 **Analytical methods:** Optical microscopy, gravimetric or fluorescent, X-ray diffraction, atomic absorption and spectrophometer
1.11.5 Use of anemometer (air)
1.11.6 **Auto ranging light meter:** Lux unit of light intensity
1.11.7 **Heat stress monitor:** Measuring instruments, calibration requirements and Procedures
1.11.8 **Microwave leakage detector:** Measuring instrument, calibration requirement and Procedure
1.11.9 Sound level meter: Measuring instrument, calibration requirement and procedure; audiometric testing
1.11.10 **Manometer:** Measuring procedure requirement
1.11.11 **Psychrometer:** Measuring procedure requirement
1.11.12 **Multimeter:** Measuring procedure requirement
1.11.12 **Wet and dry bulb hydrometer:** Measuring procedure requirement
1.11.12.1 Waste disposal sites
1.11.12.2 Chemical storage facilities
1.11.12.3 Farms, etc
1.11.13 In addition, visits to the more complicated type of premises (particularly where enforcement is by the LA) to:
1.11.13.1 Investigate particular hazardous process (boiler houses, ventilation plant rooms, dry cleaners, dangerous

toxic chemicals stores, mechanical and manual handling, prescribed dangerous machines)

1.11.13.2 Interpret defects and draft prohibition notices

1.11.13.3 Observe the role of managers and safety representatives in their dealings with each other and inspection

1.11.13.4 Visit premises where protective and management safety practices are in operation

1.11.13.5 Familiarize with the practical aspects of machine guarding

2.0 Practical

2.1 To conduct environmental risk assessment exercises, visits will be undertaken to an environmentally sensitive area including:

2.1.1 Waste disposal sites

2.1.2 Chemical storage facilities, farms etc

2.1.3 In addition, visits to the more complicated type of premises (particularly where enforcement is by the LA) to:

2.3.1 Investigate particular hazardous process (boiler houses, ventilation plant rooms, dry cleaners, dangerous toxic chemicals stores, mechanical and manual handling, prescribed dangerous machines)

2.2 Interpret defects and draft prohibition notices

2.3 Observe the role of managers and safety representatives in their dealings with each other and inspection

2.4 Visit premises where protective and management safety practices are in operation

2.5 Familiarize with the practical aspects of machine guarding

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Individual student presentations
5. Practical
6. Field demonstrations

NOTIONAL HOURS: 80 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%

1.3 Practical	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Mansdorf S. (2019). Occupational Health and Safety. 3rd ed. New York: John Wily and Sons publishers.
2. Ferrett. E., Phil. H (2012). Introduction to International Health and Safety at Work. 2nd ed. New York: Routledge

RECOMMENDED READINGS

1. GRZ. (2010). **Occupational Health and Safety Act No.36 of the Laws of Zambia**. Lusaka: Government Printers
2. GRZ. (1966). **Factories Act No.2 of the Laws of Zambia**. Lusaka: Government Printers
3. ILO. (1999). **International labour standards concerned with labour inspection main provisions**. Geneva

COURSE TITLE: ENVIRONMENTAL MONITORING AND POLLUTION CONTROL
COURSE CODE: EHS 423

INTRODUCTION
The course provides students with an understanding of environmental monitoring and pollution control. The students will be made to demonstrate the knowledge, skills and attitudes in specific areas of environmental monitoring and pollution control, and be able to enforce environmental management laws.

COURSE AIM
To enable the students demonstrate the knowledge, skills and attitudes in environmental monitoring and pollution control.

COURSE OBJECTIVES
1. Explain key concepts used in environmental monitoring and pollution control.
2. Describe the causes, effects and control measures of water pollution.
3. Explain the causes, effects and control measures of air pollution
4. Explain the causes, effects and control measures of soil pollution
5. Describe the causes, effects and control measures for noise pollution.
6. Describe the human health hazards associated with radiations
7. Describe current environmental issues
8. Describe the role of environmental education in environmental management.
9. Discuss strategic environmental assessment

COURSE LEARNING OUTCOMES
1. Identify the Links between environmental pollution and health
2. Explain key concepts used environment monitoring and pollution control.
3. Enforce environmental management laws
4. Describe international conventions and protocols in environmental management.
5. Categorize pollutants
6. Categorize types of pollution
7. Describe the causes, effects and control measures of water pollution.
8. Explain the causes, effects and control measures of air pollution.
9. Explain the causes, effects and control measures of soil pollution.
10. Describe the causes, effects and control measures for noise pollution.
11. Describe the human health hazards associated with ionising radiations.
12. Describe the role of environmental education in environmental management.
13. State the objectives of environmental impact assessment.
14. Outline the stages involved in strategic environmental assessment in Zambia.
15. Explain the importance of public involvement in environmental impact assessment
16. Review/evaluate environmental impact assessment reports

COURSE CONTENT

1.0 Introduction

1.1 Definition of the following terms: environment; environmental monitoring; pollution; and pollution control.

1.2 Legal and institutional framework for environmental management in Zambia

1.3 International conventions and protocols in environmental management: Rotterdam Convention; Stockholm Convention; and Basel convention

1.4 Categories of pollutants:

1.4.1 point sources; and

1.4.2 non-point sources

1.5 Types of pollution: water pollution; air pollution; soil pollution, noise pollution and radiation hazards.

2.0 Water Pollution

2.1 Definition of water pollution

2.2 Sources of water pollution

2.2.1 Point sources

2.2.2 Non-point sources

2.3 Categories of water pollutants

2.4 Effects of water pollution on human health and the environment

2.5 Water quality monitoring

2.6 Water pollution control

3.0 Air Pollution

3.1 Definition of air pollution

3.2 Primary and secondary air pollutants

3.3 Potential causes of air pollution

3.4 Sources and effects of air pollution on human health and the environment

3.4.1 Carbon monoxide

3.4.2 Ground-level ozone

3.4.3 Lead

3.4.4 Sulphur dioxide

3.4.5 Particulate matter

3.4.6 Nitrogen dioxide

3.4.7 Dust fall

3.5 Air quality monitoring

3.6 Air pollution control

4.0 Soil Pollution

4.1 Definition of soil pollution,

4.2 Potential causes of soil pollution,
4.3 Effects of soil pollution on human health and the environment
4.4 Soil quality monitoring
4.5 Soil pollution control

5.0 Noise Pollution
5.1 Definition of noise pollution
5.2 Causes of noise pollution
5.3 Effects of noise pollution on human health and the environment
5.4 Methods of detecting and measuring noise pollution
5.5 Noise pollution control

6.0 Radiation Hazards
6.1 Definition of radiation
6.2 Use of radiation rays
6.3 Types of radiations
6.4 Nature and properties of ionising radiations
6.5 Hazards associated with ionising radiations on human health and the environment
6.6 Monitoring ionising radiations
6.7 Control of ionising radiation hazards

7.0 HOUSEHOLD AIR POLLUTION
7.1 Definition of household air pollution
7.2 Types and Sources of household air pollutants
7.3 Adverse health effects associated with household air pollution
7.5 Prevention and control of household pollution

8.0 CURRENT ENVIRONMENTAL ISSUES
8.1 Ozone layer depletion
8.1.1 Definition of ozone layer
8.1.2 Causes of ozone layer depletion
8.1.3 Effects of ozone layer depletion on human health and the environment
8.1.4 Mitigation measures against ozone layer depletion

8.2 Acid rain
8.2.1 Introduction
8.2.2 Causes of acid rain
8.2.3 Effects of acid rain on human health and the environment
8.2.4 Preventing acid rain

8.3 Environmental education
8.3.1 Definition and scope of environmental education
8.3.2 The role of environmental education in environmental management.

8.4 Strategic environmental assessment

8.4.1 Defining strategic environmental assessment and environmental impact assessment

8.4.2 Aims/objectives of environmental impact assessment

8.4.3 Environmental impact assessment practice step-by-step

8.4.4 Public involvement in environmental impact assessment

TEACHING METHODS

1. Lectures
2. Practical
3. Group discussions
4. Field visits
5. Case studies
6. Demonstrations

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours per week
4. Laboratory work: 1 hour per week
5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Practical	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. UNEP (2004). **Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach**. Geneva: UNEP.
2. Ahmed. E. (2010). **Impact, Monitoring and Management of Environmental Pollution**. London: Nova press
3. Seren T. (2014). **Water Pollution control.** 1st ed. New York: Wiley and Songs publishers

RECOMMENDED READINGS

1. The Royal Society of Chemistry (2001). **Pollution: Causes, Effects and Control**. Fourth Edition. Cambridge: The Royal Society of Chemistry.

2. Republic of Zambia (2008) **Integrated Water Resources Management and Water Efficiency**. Lusaka: Ministry of Energy and Water Development.
3. Wright, R.T., and Boorse, D.F. (2011). **Environmental Science: Toward a Sustainable Future**. Boston: Pearson Education
4. Milnes R. (2014). **Environmental Engineering Principles and Practice.** New York: Wiley and Song

COURSE TITLE: RESEARCH METHODS
COURSE CODE: EHS 424

INTRODUCTION
The course is designed to prepare students with appropriate knowledge and skills of the research methods useful in conducting research to solve societal problems.

COURSE AIM
To provide a solid foundation for the students to apply research process in writing research report.

COURSE OBJECTIVES
1. Identify a research problem and formulate an appropriate research question/hypothesis.
2. Identify an appropriate study design and necessary data for answering the question.
3. Synthesize and interpret study results.
4. Analyse quantitative and qualitative data using frequency tables and graph

COURSE LEARNING OUTCOMES
1. Formulate research question
2. Formulate hypothesis.
3. Answer questions on the study design and necessary data
4. Conduct research
5. Synthesize and interpret study results
6. Analyse quantitative and qualitative data using frequency tables and graph

COURSE CONTENT

UNIT ONE: RESEARCH METHODOLOGY

1.0 Introduction to Research Methodology

1.1 Meaning of Research

1.2 Objectives of Research

1.3 Motivation in Research

1.4 Types of Research

1.5 Research Approaches

1.6 Significance of Research

1.7 Research Methods versus Methodology

1.8 Research and Scientific Method

1.9 Importance of Knowing How Research is Done

1.10 Research Process

1.11 Criteria of Good Research

1.12 Problems Encountered by Researchers

2.0 Defining the Research Problem

2.1 What is a Research Problem?

2.2 Selecting the Problem

2.3 Defining the Problem

2.4 Technique Involved in Defining a Problem

3.0 Research Design

3.1 Meaning of Research Design

3.2 Need for Research Design

3.3 Features of a Good Design

3.4 Important Concepts Relating to Research Design

3.5 Different Research Designs

3.6 Basic Principles of Experimental Designs

3.7 Developing a Research Plan

4.0 Sampling Design

4.1 Census and Sample Survey

4.2 Implications of a Sample Design

4.3 Steps in Sampling Design

4.4 Criteria of Selecting a Sampling Procedure

4.5 Characteristics of a Good Sample Design

4.6 Different Types of Sample Designs

4.7 How to Select a Random Sample?

4.8 Random Sample from an Infinite Universe

4.9 Sample size calculation

4.8.1 Estimating Population Proportion

8.10 Precautions for Writing Research Reports
8.11 Conclusions

9.0 Practical research proposal writing
9.1 Identify research problem
9.2 Conduct preliminary literature review
9.3 Write statement of the problem
9.4 Develop research objectives
9.5 Design research methodology
9.6 Write research proposal

TEACHING METHODS
7. Lectures
8. Tutorials
9. Practical
10. Group discussions
11. Presentations

NOTIONAL HOURS: 80 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	20%

2.0 Final Examinations	**60%**
2.1Theory	30%
2.2 Research proposal	30%

PRESCRIBED READING

1. Shantanu K. Tejnder J. (2016). **Research Methodology. Latest edition.** Agra: SBPD Publications.
2. Dr. Kumar R. (2015). **Research Methodology A Step-by-Step Guide for Beginners**. 3rded. Los Angeles: SAGE Publication Inc

RECOMMENDED BOOKS

1. David G., John. W. (2015). **Research Design: Qualitative, Quantitative and Mixed Methods Approach**. 3rd ed. Canada Centre of Science and Education.
2. Kothari, C.R. (2004). **Research Methodology: Methods and Techniques**. New Delhi:

New Age International (P) Ltd.

COURSE TITLE: INDUSTRIAL TRAINING
COURSE CODE: EHS 425

INTRODUCTION

The course provides students opportunity to undertake practical experience in various industrial activities related to environmental management and occupational health and safety. The students are attached to industries such as building construction, manufacturing, abattoirs, food processing and mining in order to not only know how they operate, but also to identify hazards in that industry and produce a written report with appropriate control measures and recommendations.

COURSE AIM

The course provides students opportunity to undertake practical experience in various industrial activities. This practical training is twofold: one is to expose students to industrial management of pollutants, and the second one is to expose students to industrial occupational health and safety so that they are able to identify hazards in an industry of operation.

COURSE OBJECTIVES

1. Develop the capacity to work effectively with related professional groups.
2. Expose students to industrial processes that falls within five pillars of environmental health training and practice
3. Attain practical competences in the fields highlighted in the practical Log Book
4. Produce a well written report which reveals the hazards in that industry with appropriate control measures

COURSE LEARNING OUTCOMES

1. To demonstrate sufficient understanding to be able to review the controls over high hazard processes or activities
2. To demonstrate the ability to identify hazards in the workplace and to identify solutions to remove/reduce or control the risk involved.
3. To demonstrate the ability to carry out an occupational accident investigation and advise on measures to prevent a recurrence.
4. To demonstrate the ability to assess systems of work and identify unsafe practices
5. To demonstrate the ability to evaluate occupational health and safety policies for controlling workplace hazards.
6. To demonstrate the understanding of how safe environment are maintained in the workplace through the activities of safety committees and representatives
7. To demonstrate sufficient understanding of the environmental hazards as per Environmental Management Act No. 12 of 2011.
8. To demonstrate the ability to deal effectively with cases/incidences of industrial, commercial, transport and domestic noise.

9. To be able to deal with air pollution from industrial and commercial premises
10. To demonstrate the understanding of the monitoring and control of radiation and radioactive materials
7. To demonstrate the ability to monitor and model air pollution control in line with the local air quality management strategy and appreciate the available control mechanisms.
8. To demonstrate the ability to identify and deal with the environmental effects and/or the potential public health impacts of contaminated land

COURSE CONTENT

1. OCCUPATIONAL HEALTH AND SAFETY

1.1 Critically review two written risk assessment of high hazard processes or activities
1.2 Inspect three different types of workplaces with a range of occupational hazards and risks
1.3 Investigate three occupational accidents.
1.4 Assess two systems of work. Where a system was found to be unsafe describe the remedial action necessary to make the system safe.
1.5 Evaluate three written occupational health and safety policies for controlling workplace hazards
1.6 Work with at least one safety committee to achieve an improvement on occupational health and safety.

2. ENVIRONMENTAL POLLUTION CONTROL

2.1 Inspect two premises where authorisation or permit to operate is required under the Environmental Management Act of 2011
2.2 Investigate three noise cases/incidences. At least one must be in each of the three areas; transport, commercial/industrial and domestic.
2.3 Investigate at least one case incidence involving air pollution from industrial and/or commercial processes.
2.4 Monitor and control radiation and radioactive materials.
2.5 Conduct two surveys that are connected to the local air quality management strategy
2.6 Identify and deal with the environmental effects and/or the potential public health impacts of contaminated land
2.7 Monitor the air quality of emissions being discharged from industries to ensure compliance with environmental laws
2.8 Monitor the quality of effluent being discharged from industries to ensure compliance with environmental laws

3.0 PRACTICAL DEMONSTRATION OF ENVIRONMENTAL HEALTH TOOLS AND EQUIPMENT

3.1Sound level meter
3.2 Luxmeter
3.3 Personal dosimeter

3.4 Kata thermometer
3.5 Waste water sampling equipment
3.6 Noise measuring instruments
3.7 Air quality monitoring instruments

TEACHING METHODS

7. Tutorials
8. Field visits
9. Demonstrations
10. Practical attachment to industry
11. Report writing

NOTIONAL HOURS: 70 HOURS

1. Tutorial (Presentations): 1 hour per week
2. Laboratory work: 1 hour per week
3. Field work: 10 hours per week
4. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 **Summative assessment: 100%**
1.1 Presentation to peers 10%
1.2 Practical Training Log Book 60%
1.3 Report writing skills 30%

PRESCRIBED READINGS:

1. Bassett W.H. (2004). **Clay's Handbook of Environmental Health.** London: Spon Press.
2. Koren, H., Bisesi, M. (2003). **Handbook of Environmental Health: Biological, Chemical and Physical agents of Environmentally Related Disease**. Fourth Edition, Vol. 1. New York: Lewis Publishers

RECOMMENDED READINGS

1. Afubwa, S,O., and Mwanthi, A.M. (2014) **Environmental Health and Occupational Health and Safety.** Nairobi: Acrodile Publishing Ltd

2. Stewart, J. (2001). **Environmental Health and Hosing: Clay's Library of Health and the Environment.** Volume 1. London: Spon Press.

3. Fumkin, H. (2010). **Environmental Health: From Global to Local.** Second edition. San Francisco: John Wiley and Sons Ltd.

YEAR FIVE SEMESTER ONE

EHS 511	Geographical Information System and Remote Sensing in Public Health
EHS 512	Risk Assessment and Management
EHS 513	Strategic Public Relations and Ethics
EHS 514	Prosecutions and Enforcement for Public Health Protection
EHS 515	Radiation Protection and Nuclear Safety
EHS 516	Research Project

COURSE TITLE: GEOGRAPHICAL INFORMATION SYSTEM AND REMOTE SENSING IN PUBLIC HEALTH

COURSE CODE: EHS 511

INTRODUCTION

The course provides students with an introduction to this exciting and expanding field of inquiry Geographic information systems (GIS) have emerged as an important method for performing public and environmental health analyses. GIS is generally seen as a spatial analysis system for the organization, storage, retrieval and analysis of data for which the location and other spatial attributes are considered important (e.g., incidence of a specific disease condition in relation to a pollution source). Students will develop a strong understanding of the tools and techniques used to display, process, and analyze remotely sensed data

COURSE AIM

The course aims at equipping students with basic practical skill applications of fundamental remotely sensed data, geographic and cartographic concepts that underlie GIS and be able to apply any of the following assessment methods: quantitative risk assessment; burden of disease using disability-adjusted life years; spatial analysis and geographic information systems; health impact assessment; alternatives assessment.

COURSE OBJECTIVES

1. Explain the fundamental geographic and cartographic concepts and principles that underlie GIS
2. Demonstrate the understanding and working knowledge of Arc GIS, a powerful "desktop" GIS software package that runs in a Windows environment.
3. Explain the knowledge of past, present, and possible future applications of GIS for public health and environmental studies
4. Describe the ethical, political, organizational, and economic issues related to GIS
5. Describe the basic principles of remote sensing
6. Explain the remote sensing workflow
7. Analyze remotely sensed data using the principles of the remote sensing workflow

COURSE LEARNING OUTCOMES

1. Use computer systems and analytic software packages: desktop GIS software packages including Arc GIS and other spat al analysis software such as GWR, GeoDa, and SaTScan.
2. Identify areas of uncertainty in exposure and risk assessment processes.
3. Retrieve and organize literature; synthesize and critically evaluate scientific literature in environmental health, public health and other relevant fields.

4. Use existing databases to provide background information or data to address research questions and draw appropriate inferences/estimates from environmental health data.
5. Evaluate seminars and presentations in environmental health and distil the critical and salient issues from them.
6. Produce working tables, statistical summaries, and effective figures to summarize data.
7. Prepare presentation materials including outlines, posters, and PowerPoint presentations.
8. Deliver effective oral presentations individually and as part of a team.
9. Develop multi-step remote sensing workflows to solve problems in a variety of application areas;
10. Apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate remote sensing data and processing methods.
11. Clearly and concisely communicate findings from the analysis of remotely sensed data through the written word and graphical products

COURSE CONTENT

1.0 Introduction to GIS Concepts and Methods

1.1 GIS and Public Health

1.1.1 Overview of Applications

1.1.2 GIS Mapping as a Public Health Tool

1.1.3 Public Participation GIS and Health

1.2 GIS and Spatial Data

1.3 Spatial Databases for Public Health

1.4 Basic Spatial Analysis for Cluster Pattern and Cluster Detection

1.5 Introduction to Labs Structure and Place as Determinant of Health

1.6 Mapping Disease and Health: Past and present (Lab work)

1.6.1. GIS Background and Arc GIS

1.6.2 Analysing Spatial Clustering of Health Events

1.7 Environmental Hazards

1.7.1 Analysing risks

1.7.2 Spread of infectious diseases

1.7.3 Responding to disease outbreaks and epidemics (interactive maps analysis and communication during outbreaks

1.8 Disease Diffusion

1.9 Analysing Access to Health Services

1.9.1 Spatial Analysis for Public Health

1.9.2 Locating Health Services

1.9.3 Health Disparities

1.10 Case Studies: Studying food borne disease outbreaks;

1.11 Spatial Statistics for Public Health:

1.11.1 Neighbourhood and Health

1.11.2 GIS and Community Health

1.11.2 Prevalence estimates and spatial statistics

1.12 Data structure and projects

1.12.1 Ecology of Vector-Borne Disease; Analysing Access to Health Services

1.13 Data management and tables with Geocoding

2.0 Global Positioning System (GPS) and Digital Data

2.1 Introduction to Remote Sensing

2.2 The Remote Sensing Analytical Process

2.2.1 Principles of Remote Sensing

2.2.2 Remote sensing workflow

2.2.3 Analysis of remotely sensed data using principles of remote sensing workflow

2.3 Pre-processing of Remotely Sensed Data

2.3.1 Spatial preprocessing techniques to image data
2.3.2 Spectral preprocessing techniques to image data
2.3.4 Manage image data using mosaics and compression
2.3.5 Create surface models from lidar data

2.4 Image Interpretation

2.4.1 Define the elements of image interpretation
2.4.2 Interpret remotely sensed data using the elements of image interpretation
2.4.3 Construct an image interpretation key

2.5 Feature Extraction

2.5.1 Pixel and object-based approaches to feature extraction
2.5.2 Supervised and unsupervised approaches to feature extraction
2.5.3 Classification using spectral information
2.5.4 Classification using geometric information
2.5.5 Classification using texture information

2.6 Change Detection

2.6.1 Detect thematic change over time from two dates of multispectral imagery
2.6.2 Detect thematic change over time using lidar data
2.6.3 Detect thematic change from radar data using coherent change detection techniques

2.7 Accuracy Assessment

2.7.1 Principles of classification accuracy assessment;
2.7.2Construct an accuracy assessment error matrix;
2.7.3 Principles of classification accuracy assessment in a typical application setting;
2.7.4 Design and deploy a workflow for mapping an urban heat island;
2.7.5 Detect thematic change over time from two dates of multispectral imagery;
2.7.6 Detect thematic change from radar data using coherent change detection techniques;
2.7.7 Formulate an integrated workflow for mapping inundation areas.

3.0 Project Assignment in GIS

TEACHING METHODS

1. Lectures
2. Practical
3. Demonstrations

NOTIONAL HOURS: 120 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Laboratory work: 2 hours per week
4. Assessment and self-study: 2 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment: 50%
1.1 2 Tests: 10%
1.2 2 Assignments: 10%
1.3 Computer lab work 30%

2.0 **Final Examinations: 50%**
2.1 Theory: 20%
2.2 Practical 30%

PRESCRIBED READINGS

1. Magnuson J., Paul f. (2014). **Public Health Informatics and Information System**. 2nd ed. Netherland: Springer press
2. Jerrett, M., Gale, S., & Kontgis, C. (2010). **Spatial Modelling in Environmental and Public Health Research. International Journal of Environmental Research and Public Health**, 7(4), 1302-1329.
3. Campbell (2011). **Introduction to Remote Sensing**. 5th Edition. Netherland: Springer press
4. Ellen k., Sera M. (2011). **GIS and Public Health**. 2nd ed. Illinois: the Guilford press

RECOMMENDED READINGS

1. Kristen S., Wilpen L (2014) **GIS Tutorial for Health.** 5th ed. London: Elsevier press

2. Olson, C.E. (2009). **"Is 80% Accuracy Good Enough?" In *Proceedings of the ASPRS 17th Pecora Conference***.

COURSE TITLE: RISK ASSESSMENT AND MANAGEMENT
COURSE CODE: EHS 512

INTRODUCTION

The course is designed to introduce the students to theoretical foundations of (eco) toxicology of chemicals and the principles of exposure, effects and risk assessment of chemicals to man and the environment. A strong focus is on understanding how different physical, chemical, biological and ecological processes contribute to chemicals exposure, effects and, ultimately, risk.

COURSE AIM

To enable students and acquire knowledge and skills in environmental risk assessment and human health risk assessment.

COURSE OBJECTIVES

1. Define the principles of environmental risk assessment, including detailing the steps in the risk assessment process.
2. Explain the principles of environmental risk management, administration and planning.
3. Determine the toxicity of a compound through literature research and explain in terms of human health and ecosystem impacts.
4. Explain the role of government policy to address environmental risk assessment and management.
5. Demonstrate the understanding of theoretical knowledge in assessing and managing effects of chemicals on the environment and ecosystems,
6. Identify political institutions, knowledge infrastructure and knowledge institutions that are relevant to environmental risk assessment regulation.
7. Explain how considerations of environmental risk can be integrated into social and technological development.

COURSE LEARNING OUTCOMES

1. Utilise key ecological and environmental biological theories, methods and models to solve practical, application-oriented issues of environmental risk.
2. Demonstrate the understanding of physical, chemical, biological and ecological processes that determine exposure, effects and risks of chemical to man and the environment
3. Interpret, critically analyze and report on scientific literature on (eco) toxicology or risk assessment.

4. Demonstrate the understanding of theoretical knowledge and its application in assessing and managing effects of chemicals on the environment and ecosystems,
5. Conduct risk assessment matrix
6. Quantify environmental risks and human health risks.

COURSE CONTENT

1.0 General introduction

1.1 Definition of terms: hazards, risks, risk assessment and risk management

1.2 Chemicals are everywhere… but risks?

1.3 Awakening to environmental problems

1.4 (Eco)toxicology and Risk Assessment

1.5 The Risk management process

1.6 Risk Assessment Matrix

1.7 Risk Assessment: Risk Characterization through Exposure Assessment and Effects Assessment

2.0 Environmental Exposure Assessment

2.1 Emission

2.2 Equilibrium partitioning

2.3 Intra- and inter-media transport

2.4 Transformation (degradation)

2.5 (External) Exposure assessment (concentrations in water, air, soil & sediment)

2.6 (Internal) Exposure assessment (bioconcentration, bioaccumulation & biomagnification)

3.0 Ecotoxicology at sub-organism level

3.1 Uptake, biotransformation, detoxification and elimination

3.2 Molecular and cellular effects

3.3 Adverse outcome pathways

4.0 Ecotoxicology at organism level

4.1 Factors to consider in ecotoxicity tests

4.2 Standardization and guidelines

4.3 Analysis of toxicity test results

4.4 PNEC derivation

4.5 Secondary poisoning

4.6 Effect QSARs

5.0 Ecotoxicology at Population, Community and Ecosystem Level

5.1 Populations: endpoints

5.2 Populations: determinants

5.3 Communities: endpoints

5.4 Communities: determinants

6.0 Ecological risk assessment and legislation
6.1 Zambia Pesticides and Toxic Substances Statutory Instrument
6.2 REACH
6.3 Global Harmonized System (GHS) and Classification, Labelling and Packaging (CLP)
6.4 EU pesticide regulation
6.5 OECD Chemicals programme

7.0 Human toxicology and risk assessment
7.1 General framework and aspects of toxicity
7.2 Effects (hazard) assessment
7.3 Exposure assessment
7.4 Risk characterization
7.5 Risk management

TEACHING METHODS
1. Lectures
2. Group discussions
3. Computer exercise
4. Presentations
5. Case studies

NOTIONAL HOURS: 100 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 2 hours per week
4. Seminar: 1 hour per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Calculation	20%

PRESCRIBED READINGS
1. Aven T., Enrico Z (2017). **Knowledge in Risk Assessment and Management**. 1st ed. Wiley and sons publishers.

2. Ricci P. (2019). **Analysis of Catastrophes and their Public Health Consequences**. Netherlands: Springer press.

RECOMMENDED READINGS

1. Aven T., (2019). **The Science of Risk Analysis: Foundation and Practice**. 1st ed. UK Routledge

COURSE TITLE: STRATEGIC PUBLIC RELATIONS AND ETHICS
COURSE CODE: EHS 513

INTRODUCTION

This course provides students with a detailed introduction to public relations, including its historical origins, and its distinctions from advertising. Students will study theories of the public and public relations theory, while learning the many roles of the public relations in Public Health. Through case studies students will examine the legal and ethical concerns of Public Relations while studying the press release, newsletter, and personal appearances

COURSE AIM

The course aims at providing students with the knowledge, skills and attitude in understanding the basic concepts and principles of public relations, professional ethics in public health as well as communications studies

COURSE OBJECTIVES

3. Define the terms in Public Relations
4. Explain the role and functions of Public Relations in Public Health
2. Discuss the nature and challenges of public relations work
3. Explain the importance of effective writing skills as they apply to public relations advertising, and sales for target audiences
4. Elucidate the role and functions of public relations in Public Health
5. Apply the basic elements of planning and research to strategic writing for public relations, advertising, sales, marketing, and business communication
6. Explain historical evolution of public relations and professional/ethical/legal responsibilities
7. Describe the basic process of public relations — research, planning, communication
8. Outline various communications strategies to achieve organizational goals.
9. Explain the concepts of public relations, audience analyses, and persuasion

COURSE LEARNING OUTCOMES

1. Use practical guidelines for utilizing written, spoken, and visual techniques to reach the selected audience.
2. Employ writing to appeal to audiences through a variety of mediums, including speech, print, broadcasting, and advertising
3. Apply principles of persuasion and conflict management to public relations campaign design

4. Adapt strategies and tactics of public relations campaigns to fit diverse audiences and clients
5. Identify the ethical and legal dimensions of working in the public relations field

COURSE CONTENT

UNIT ONE: STRATEGIC PUBLIC RELATIONS AND ETHICS

UNIT ONE: PUBLIC RELATIONS IN PUBLIC HEALTH

1.0 **PURPOSE AND COURSE OVERVIEW**
1.1 Defining Public Relations (PR) and the Public
1.2 Misconceptions about Public Relations
1.3 Theories of the public and public relations theory
1.4 The history of Public Relations
1.5 Functions of Public Relations
1.6 Public Relations in the Health Care Industry 1.6.1 Where does Public Relations fit in Public Health?
1.6.1 Roles of the public relations practitioner in Public Health
1.6.2 Value of public relations in influencing decision-making
1.6.3 Role of PR in influencing Public opinion

2.0 INTRODUCTION TO PUBLIC RELATIONS PLANNING IN PUBLIC HEALTH
2.1 Planning, theory and models
2.2 Communication process: objectives, messages, publics and communication channels
2.3 Identification of communication assets (liabilities via a communication audit)
2.4 Communication and The Art of persuation
2.5 Application of Weik's model of organising health care and health promotion
2.6 Public Relations: Strategies and Tactics
2.7 Personal Skills and Development
2.8 Implementing effective improvement strategies in Public health
2.9 Measurement and output evaluation of Public Relations' effectiveness in Public Health

3.0 IMPLICATIONS OF SOCIAL MEDIA FOR PUBLIC RELATIONS IN PRACTICE:
3.1 Particular challenges associated with digital/social media
2.2 Outline of main digital media and their implications/use for public relations
3.3 Social media do's and don'ts

4.0 WRITING FOR TRADITIONAL MEDIA
4.1 Writing features (including comment pieces) and press releases
4.2 Writing blogs, tweets, FAQs and web content

4.3 Podcasts, multi-media releases, viral videos and photography
4.4 New technologies in public relations

UNIT TWO: ETHICS AND PROFESSION
1.0 Introduction
1.1 What a Profession?
1.1.1 Characteristics of a Profession
1.1.2 What it means to be a Professional

2.0 **Ethics**
2.1 Definition of ethics
2.2 Code of ethics for Environmental Health Practitioners
2.3 Core ethical values and standards for Environmental Health Practitioners
2.4 Prescribed ethical and professional rules (Refer to HPCZ)

3.0 **How to resolve ethical dilemmas**
3.1 Formulating the problem
3.2 Gathering information
3.3 Consider options
3.4 Make a moral assessment
3.5 Using framework of ethics in making difficult choices
  3.5.1 Evidence of effectiveness
  3.5.2 Equity
  3.5.3 Patient choice
4.0 Main responsibilities of Environmental Health Practitioners

5.0 Rules of conduct prescribed by the Professional Board of Environmental Health Practitioners (PBEHP)

6.0 **Principles of ethical debate and behaviour**
6.1 Autonomy
6.2 Beneficence
6.3 Non-maleficence
6.4 Justice

TEACHING METHODS
1. Lectures
2. Tutorials
4. Demonstrations
5. Group discussions

NOTIONAL HOURS: 80 HOURS
1. Lectures: 3 hours per week

2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 Continuous assessment:	**40%**
1.1 2 Tests:	10%
1.2 1.2 2 Assignments:	10%
1.3 Field Practical	20%
2.0 Final Examinations:	**60%**
2.1 Theory:	60%

PRESCRIBED READINGS

1. Wilcox and Cameron (2012). **Public Relations: Strategies and Tactics.** 10th ed. Boston: Pearson.
2. Joan E., Martin B. (2013). **Planning Ethical Responsible Research**. 2nd ed. London: SAGE Publishing.

RECOMMENDED READINGS

1. Richard P. (2011). **Good Strategy/ Bad Strategy: The Difference and why it Matters.** 1st ed. Currency illustrated
2. Seith B. (2011). Strategic Planning: **A practical Guide to Strategy Formulation and Executive**. 1st ed. London SAGE Publishing/

COURSE TITLE: PROSECUTIONS AND ENFORCEMENT FOR PUBLIC HEALH PROTECTION

COURSE CODE: EHS 514

INTRODUCTION

The course is designed to equip students with knowledge and practical skills in the enforcement of relevant pieces of legislation and prosecute the violators of the law in order to ensure that public health interests are secured. Environmental Health Practitioners and other Enforcement Officers cited in the Law work on behalf of the state and therefore have the responsibility to conduct investigations during formal and informal inspections and prosecute all reported crime and fraud on behalf of society generally related to water supply, liquid and solid waste, food safety and other specified public health risks that fall under public health protection. The role and responsibilities of authorized officers authorized is to collect evidence and bring cases to court for consideration. Advice is included about the quality (standard) of evidence that must be attained in order for that evidence to allow to be used in court. Otherwise the evidence will not be admissible. The conduct of a prosecution, including advice on witness testimony, is also addressed in the course.

COURSE AIM

The course aims to give students more visibility to the issue of enforcement of public health legislation so that during training health enforcement will be better understood and supported. Effective and fair enforcement of public health law is a critical component of every government's responsibility to improve and protect the public health of all people in their country.

COURSE OBJECTIVES

1. Explain the sources of law in Zambia
2. Demonstrate an understanding of practical skills of court procedures in civil and criminal matters
3. Demonstrate an understanding of delegated legislation
4. Demonstrate an understanding of the two principal Acts (the Public Health Act Cap 295 and the Food Safety Act Cap 303 of the Laws of Zambia in relation to the duties of authorised officers)
5. Explain inspection procedure of premises and prepare cases as well as legal documents for court proceedings

6. Demonstrate legal knowledge on how to cite sections and chapters of the laws of Zambia in relation to offences.

COURSE LEARNING OUTCOMES

1. Use of correct legal procedures when taking actions as well as defending legal proceedings when need arises.
2. Exercise powers as a statutory officer and understand the limitations of those powers in the day to day operations
3. Ensure that prosecution decisions are made in a fair, consistent and transparent manner and that those who make the decisions are accountable
4. Interpret various public health legislations
5. Enforce public health laws
6. Identifies public health violations
7. Prosecute public health offenders

COURSE CONTENT

1.0 INTRODUCTION

1.1 Definitions of terms

1.1.1 Prosecution

1.1.2 Enforcement

1.1.3 Authorised Officer

1.1.4 Public Health Protection

1.2 Importance of legal enforcement in Zambia

2.0 CIVIL AND CRIMINAL PROCEDURE

2.1 Institution of criminal proceedings in the Courts of Law

2.1.1 Complaint/ summons

2.1.2 Arrest with or without a warrant

2.2 Judicial systems:

2.2.1 Structure of courts and legal systems

2.2.2 Forms of liability

2.2.3 Civil actions

2.2.4 Arbitration

2.2.5 Court personnel

2.2.6 Legal processes and Tribunals

2.3 Legal documents

2.3.1 Inspection report

2.3.2 Camera

2.3.3 Warning notice

2.3.4 Court order

2.3.5 Closure notice

2.3.6 Forms (formal and informal)

2.3.7 Seizure forms

2.3.8 Disposal of exhibits

2.3.9 Complaint

- Summons

2.3.10 Charge sheet or indictment

2.3.11 Statement of facts

2.3.12 Prosecutions

2.4 Institution of civil proceedings

2.4.1 Summons

- Writ of summons
- Default writ of summons
- Affidavits
- Filing

2.5 Procedure in court

2.5.1 Plea of guilty
2.5.2 Plea of not guilty
2.5.3 Trial
2.5.4 Examination in chief
2.5.5 Cross examination
2.5.6 Re examination
2.5.7 Closure of case
2.5.8 Submissions
2.5.9 Ruling
2.5.10 Defence (if put on defence same procedure if not acquittal)
2.5.11 Judgment (if convicted then mitigation; if not convicted then acquittal)
2.5.12 Sentence / Appeals (Withdraw / discharge)

3.0 **SELECTED OFFENCES**

3.1 Obstruction of an authorised officer
3.2 Causing a nuisance liable to be injurious or dangerous to health
3.3 Failing to provide adequate sanitary facilities
3.4 Failing to provide toilets
3.5 Selling, preparing, packaging and storing of food under insanitary conditions
3.6 Deposing of waste in an undesignated disposal site
3.7 Selling meat that is not examined and certified fit for human consumption
3.8 Slaughtering animals that are not examined by the veterinary officer
3.9 Failing to take reasonable measures and precautions to ensure that thorough medical examinations are made on people handling food.
3.10 Selling to the public food staffs not of nature, substance or quality
3.11 Selling expired food staffs
3.12 Selling unlabelled food staffs
3.13 Selling food not inconformity with hygiene standards
3.14 Accumulating or keeping waste upon premise beyond the regular collection point
3.15 Selling liquor without a licenceSelling liquor before and after permitted hours
3.1.15 Causing pollution
3.17 Trading on a residential premises without change of use

4.0 **HEALTH STATUTES**

4.1 The Public Health Act, Cap 295 of the Laws of Zambia
4.2 Liquor Licensing Act No. 20 of 2011 of the Laws of Zambia
4.3 ZEMA Act No. 12 of 2011 of the Laws of Zambia
4.4 The Factories Act, Cap 441 of the Laws of Zambia
4.5 Local government Act Cap 281 of the laws of Zambia
4.6 Chiefs Act Cap 287 of the Laws of Zambia
4.7 Village and Development Act Cap 289 of the Laws of Zambia
4.8 Town and Country planning Act Cap 283
4.9 Narcotic and psychotropic substances Act Cap 96 of the Laws of Zambia and their Regulations
4.10 Water supply and Sanitation Act (No. 28 of 1997)
4.11 Trades Licensing Act. Cap 393
4.12 Standards Act. Cap. 416
4.13 Factories Act Cap 441
4.14 Criminal Procedure Code Act. Cap 88
4.15 Penal Code Act. Cap. 113
4.16 Hotels Act Cap. 153
4.18 Prevention of cruelty to animals Act. Cap. 245
4.19 Stock diseases Act. Cap. 252; and Regulations there under

5.0 **STATUTORY INSTRUMENTS**
5.1 S.I No. 44 of 2007 of the Local Government Act Cap 281 of the Laws of Zambia, (Street Vending and Nuisances)
5.2 S.I No. 64 of 2012 of the Local of the Local Government Act Cap 281 of the Laws of Zambia. (permitted hours)
5.3 S.I No. 70 of 2011 of the Local Government Act Cap 281 of the Laws of Zambia, (Business Levy)
5.4 S.I No. 39 of 2008 of the Local Government Cap 281 of the Laws of Zambia (prohibition of Smoking in Public)
5.5 S.I No. 48 of 2006 of the Food Safety Act Cap 303 of the Laws of Zambia. (Breast milk substitute)
5.6 S.I No. 163 of the Public Health Act Cap 295 of the Laws of Zambia (tobacco regulation of 1992)
5.7 S.I No. 90 of 2001 of the Food Safety Act Cap 303 of the Laws of Zambia

6.0 **ENFORCEMENT AGENCIES AND AUTHORISATION LOCAL GOVERNMENT**
6.1 Central Government, Local Authorities and District Health Offices
6.2 Health Inspectors, Pharmacy and Poison Inspectors,
6.3 Chemical Inspectors, Health and Safety Inspectors and Factory Inspectors

7.0 CITATIONS OF THE LAWS OF ZAMBIA
7.1 Acts of Parliament
7.2 Statutory Instruments
7.3 By –Laws

7.4 Regulations and Resolutions

8.0 LEGAL ENFORCEMENT TRIANGLE

9.0 MOOT COURT

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations
7. Attending court sessions

NOTIONAL HOURS: 150 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 3 hours per week
4. Seminar: 2 hours per week
5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.3 Court report	10%
2. Final Examinations	**60%**
2.1 Theory	40%
2.2 Court report	20%

PRESCRIBED READINGS

1. Hage J., Akermans B. (2014). Introduction to Law. Switzerland: Springer international publishers
2. Poonam D., Snnath R. (2017). **International Encyclopaedia of Public Health Law**. 2nd ed. London: Science direct publishers.
3. Smith J.C and Hogan B. (2002) **Criminal Law.** London**:** Butterworths

RECOMMENDEDREADINGS

1. GRZ (1991) Criminal Procedure Code Act Chapter 88 of the Laws of Zambia. Lusaka: Government Printers
2. GRZ. Penal Code Chapter 87 of the Laws of Zambia: Lusaka: Government Printers 3. Kulusika E. Simon (2006) **Text, cases and Materials on Criminal Law in Zambia**. Lusaka: UNZA Press

COURSE TITLE: RADIATION PROTECTION AND NUCLEAR SAFETY
COURSE CODE: EHS 515

INTRODUCTION

The course is designed to provide students with the understanding of basic fundamentals of radiation protection and nuclear safety to enable them manage nuclear risks and industrial hazards, and protect local communities and the environment during construction, operation and dismantlement of nuclear facilities. The quest for excellence in nuclear and radiation safety calls for an integrated approach to education and training. Both radiation protection and nuclear safety are, by and large, multidisciplinary fields comprising interrelated parts of applied physics, chemistry, biology, nuclear technology, and other specialized areas.

COURSE AIM

The course aims at equipping students with knowledge, skills and attitude on the basic radiation protection and nuclear safety fundamentals applicable for protection against ionising radiation and associated risks that ultimately may affect the health of humans and of the environment.

COURSE OBJECTIVES

Explain the concepts of radiation dosimetry to workplace and public exposure scenarios

1. Describe and explain the biological basis for radiation protection measures and regulations
2. Interpret and apply radiation safety guides and regulations to workplace and public exposure Scenarios
3. Explain the causes and consequences of situations of chronic exposure and of radiological and nuclear accidents, and of approaches to mitigating the consequences
4. Describe the mechanisms of different types of biological effects following exposure to ionizing radiation.
5. Describe the function and limitations of radiation protection instrumentation
6. Describe the concept of criticality
7. Explain the role played by international organizations in radiation protection
8. Elucidate the fundamental principles of non-ionizing radiation safety.

COURSE LEARNING OUTCOMES

6. Demonstrate the understanding of dosimetric quantities and their measurement units and to perform related calculations.
7. Familiarise with different types of radiation detectors and their operating principles, characteristics and limitations

3. Apply the radiation protection principles to medical exposures (diagnostic and interventional radiology, radiotherapy and the nuclear medicine)
8. Choose the appropriate detector for a given radiation field and dosimetric quantities
9. Familiarise with the mechanisms of different types of biological effects following exposure to ionizing radiation. To be aware of the models used to derive risk coefficients for estimating the detriment
10. Apply fundamental radiation safety principles to external and internal exposure scenarios
11. Demonstrate the understanding of the ICRP's conceptual framework and international recommendations in radiation protection and safe use of radiation sources.
12. Demonstrate the understanding of the role played by international organizations in radiation protection

COURSE CONTENT

1.0 NTRODUCTION

1.1 Overview of radiation protection and nuclear safety

2.0 REVIEW OF FUNDAMENTALS

2.1 Basic physics and mathematics used in radiation protection

2.1.1 Basic nuclear physics

2.1.1.1 Introduction to atomic structure (Neutrons, protons and electrons; periodic table; atomic mass, isotopes of element; excitation, ionization; binding energy; accelerated particles; characteristic X rays, bremsstrahlung; auger electrons, internal conversion; energies)

2.1.2 Radioactivity

2.12.1 Nuclear stability; unstable nuclei; radionuclides; modes of disintegration alpha, beta, gamma; types of spectra; positron; electron capture; table of radionuclides; activity; law of radioactive decay; half-life; decay constant; mean life; activity, units; decay chains and equilibrium

2.1.3 Nuclear reactions

2.1.3.1 Types of reactions; induced radioactivity; fission and fusion (energy considerations); cross section; energetics of reactions)

2.1.4 Basic mathematics

2.1.4.1 Differentiation/integration; decay equations (exponential functions); first order ordinary linear differential equations with a constant

2.1.5 Statistics

2.1.5.1 Accuracy; precision; reliability; student T test; Chi square; probability theory;

2.1.5.2 random variables; distributions: different types (log-normal, binomial, Poisson, Gaussian); scatter diagram; mean, mode, median; standard deviation; standard error; confidence levels; regression; correlation; practical application to counting; curve fitting by least square methods

2.2 Interaction of radiation with matter

2.2.1 Charged particle radiation

2.2.1.1 Heavy particles (alpha, proton nuclei)

2.2.1.2 Energy transfer mechanisms, ionization, scattering nuclear interaction; range–energy relationship; Bragg curve; stopping power; shielding

2.2.2 Beta particles

2.2.3 Mechanisms of energy transfer; relationships; bremsstrahlung; Cerenkov radiation; shielding

2.2.4 Uncharged radiation

2.2.4.1 X and gamma rays

2.2.4.2 Photoelectric effect; Compton scattering; pair production; secondary photon production; linear mass attenuation coefficient; exponential attenuation; effect of Z on absorbing medium; buildup correction; shielding

2.2.4 Neutrons (Interaction; scattering; absorption; energy categories; neutron activation; radioactive capture; moderation; shielding

2.2.6 Induced radioactivity: by charged and uncharged particles

2.3 Sources of radiation

2.3.1 Natural radiation

2.4.1.1 Terrestrial radionuclides: Uranium (235U and 238U), 232Th, 40K; important radionuclides 238U and 232Th decay chains (Radon,Rn emanation, NORM Cosmic radiation: types of cosmic radiation; variation with latitude and altitude

2.3.2 Human made radioactive sources

2.4.2.1 Radioactive sources: beta, alpha, gamma and X ray sources;isotopic neutron sources; unsealed sources; unsealed sources and isotope generators; source enclosures; fallout; general safety of radiation sources; production of radioisotopes Nuclear reactors: review of fission and fusion reactions; moderation of neutrons; neutrons, multiplication factor, criticality; basic elements of a nuclear reactor; types of reactors; research reactors; nuclear fuel cycle installations

2.3.3 Radiation generators

2.3.3.1 Charged particle production: linear accelerators; betatrons; cyclotrons

2.3.3.2 X ray production: low energy X ray machines; linear accelerators; other machines; principles and spectra; filtration and beam quality

2.3.3.3 Neutron production: (d,n) reactions and (p,n) reactions; neutron production for neutron therapy

2.3.4 Applications of ionizing radiation in medicine, industry, and agriculture

2.3.5 Consumer products

3.0 QUANTITIES AND MEASUREMENTS

3.1 Quantities and units

3.2 Dosimetric calculations and measurements

3.3 Principles of radiation detection and measurement

4.0 BIOLOGICAL EFFECTS OF IONIZING RADIATION

4.1 Effects of radiation at the molecular and the cellular level

4.2 Deterministic effects

4.3 Stochastic somatic effects
4.4 Stochastic hereditary effects
4.5 Effects on the embryo and foetus
4.6 Epidemiological studies and issues
4.7 The concept of radiation detriment

5.0 PRINCIPLES OF RADIATION PROTECTION AND THE INTERNATIONAL FRAMEWORK REGULATORY CONTROL

5.1 The ICRP Basic Conceptual Framework
5.2 The role of international organizations in radiation protection
5.3 The development of safety culture
5.4 Legal framework for radiation protection and the safe use of radiation sources
5.5 Regulatory system
5.6 Assessment of effectiveness of the regulatory programmes

6.0 ASSESSMENT OF EXTERNAL AND INTERNAL EXPOSURES

6.1 Assessment of occupational exposure due to external sources of radiation
6.2 Assessment of occupational exposure due to intakes of radionuclides

7.0 PROTECTION AGAINST OCCUPATIONAL EXPOSURE

7.1 Organization of radiation protection and management
7.2 Methods of protection and the safe use of radiation sources; optimization
7.3 Individual and workplace monitoring
7.4 Health surveillance
7.5 Potential exposures
7.6 Protection against occupational exposure in industrial radiography
7.7 Protection against occupational exposure in industrial irradiators and accelerators
7.8 Protection against Occupational Exposure in the Use of Nuclear Gauges
7.9 Protection against occupational exposure in the use of tracers
7.10 Protection against occupational exposure in well logging devices
7.11 Protection against occupational exposure in radioisotope production plants
7.12 Protection against occupational exposure in mining and processing of raw materials
7.13 Protection against occupational exposure in nuclear installations
7.14 Protection against occupational exposure in radiotherapy
7.15 Protection against occupational exposure in nuclear medicine
7.16 Protection against occupational exposure in diagnostic radiology

8.0 MEDICAL EXPOSURES IN DIAGNOSTIC RADIOLOGY, RADIOTHERAPY AND NUCLEAR MEDICINE

8.1 Scope and responsibilities
8.2 Justification of medical exposures

8.3 Optimization of protection for medical exposures
8.4 Quality assurance
8.5 Accidental exposures in medical applications

9.0 EXPOSURE OF THE PUBLIC DUE TO PRACTICES
9.1 Sources of exposure of the public
9.2 Responsibilities and organization
9.3 Safe transport of radioactive material
9.4 Safety of radioactive waste management
9.5 Environmental dose assessment
9.6 Source and environmental monitoring
9.7 Consumer products

10.0 INTERVENTION IN SITUATIONS OF CHRONIC AND EMERGENCY
10.1 General principles and types of events
10.2 Basic concepts for emergency response
10.3 Basic concepts for emergency preparedness for a nuclear accident or radiological emergency
10.4 Developing a national capability for response to a nuclear accident or radiological Emergency
10.5 Overview of assessment and response in a radiological emergency
10.6 Overview of assessment and response in a nuclear reactor emergency
10.7 Monitoring in a nuclear accident or radiological emergency
10.8 Medical management of radiation injuries

TEACHING METHODS
1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations
7. Practical

NOTIONAL HOURS: 150 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 2 hours per week
4. Laboratory work: 1 hour per week

5. Assessment and self-study: 3 hours per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	20%
1.2 2 Assignments	10%
1.2.3 Lab test	10%

2.0 Final Examinations	**60%**
2.1 Theory	40%
2.2 Practical	20%

PRESCRIBED READINGS

1. Saha B. (2019). **Radiation Safety in Nuclear Medicine: A Practical, Concise Guide**. 2nd ed. Netherland: springer international publishers
2. Mattsson S., et al. (2013) **Radiation Protection in Nuclear Medicine**. Netherlands: springer international publishers.
3. Obodovsky I. (2019). **Radiation: Fundamentals, Application, Risks and Safety**. 1st ed. London: Elsevier press

RECOMMENDED READINGS

1. Timothy J. (2016). **Strange Glow: The Story of Radiation**. 1st ed. Princeton university press

COURSE TITLE: RESEARCH PROJECT
COURSE CODE: EHS 516 INTRODUCTION

Health research is a systematic and principled way of obtaining evidence (data, information) for solving health care problems and investigating health issues. The primary aim of this course is to enable the student write a research report in line with Harvest University Research Guidelines.

With the help of the supervisor, the student shall be required to write a research report which will be presented to the team of evaluators/examiners where the student will be required to defend it, before it is finally graded in accordance with Harvest University Research Guidelines.

COURSE AIM

The course aims at enabling the student write the research report with the help of the supervisor in accordance with the principles of research report development.

COURSE OBJECTIVES

1. Demonstrate the procedure of developing data collection tool
2. Validate the reliability and validity of the data collection tool in terms of what it is supposed to measure
3. Demonstrate an understanding of the research ethics during data collection
4. Present different statistical methods of analysing data
5. Demonstrate the skill of writing a research report according to the Research Guidelines

COURSE LEARNING OUTCOMES

1. Test the reliability and validity of the data collection tool before the main study is conducted
2. Conduct data collection in line with the research ethics protocols
3. Data entry
4. Analyse the data using appropriate statistical tools in accordance with the research design
5. Write the research report
6. Disseminate the research findings to the relevant stakeholders using available dissemination platforms

COURSE CONTENT

1. Piloting data collection tool
2. Data collection (Primary data and Secondary data)

3. Data entry
4. Data analysis
5. Presentation of research findings and interpretation
6. Discussion of research findings
7. Conclusion and recommendations
8. Present list of references as cited in the text
9. Appendices

NOTIONAL HOURS: 100 HOURS

1. Field work: 10 hours per week
2. Dissertation writing: 6 hours per week

ASSESSMENT METHOD

1. Research Report 100%

PRESCRIBED READING

1. Shantanu K. Tejnder J. (2016). **Research Methodology. Latest edition.** Agra: SBPD Publications.
2. Dr. Kumar R. (2015). **Research Methodology A Step-by-Step Guide for Beginners**. 3rded. Los Angeles: SAGE Publication Inc

RECOMMENDED BOOKS

1. David G., John. W. (2015). **Research Design: Qualitative, Quantitative and Mixed Methods Approach**. 3rd ed. Canada centre of science and education.
2. Kothari, C.R. (2004). **Research Methodology: Methods and Techniques**. New Delhi: New Age International (P) Ltd.

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YEAR FIVE SEMESTER TWO

EHS 521	Environmental Epidemiology
EHS 522	Project Planning, Monitoring and Evaluation
EHS 523	Climate Change and Disaster Risk Reduction
EHS 524	Environmental Health Administration and Financial Management
EHS 525	Environmental Economics

COURSE TITLE: ENVIRONMENTAL EPIDEMIOLOGY
COURSE CODE: EHS 521

INTRODUCTION
To impart knowledge of conceptualizing issues, carrying out epidemiological investigation of any environmental health problem and presenting its findings.

COURSE AIM
To enable students understand and apply the principles of environmental epidemiology and epidemiological methods

COURSE OBJECTIVES
1. Demonstrate understanding the history and role of epidemiology as the basic science for public health
2. Develop a population - based perspective of disease and other health related events
3. Conduct epidemiological investigations
4. Describe steps in the conduct of epidemiological research
5. Demonstrate understanding of environmental epidemiological issues 6. Calculate, interpret and present epidemiologic data

COURSE LEARNING OUTCOMES
1. Describe history and role of epidemiology as the basic science for public health
2. Draw population - based perspective of disease and other health related events
3. Conduct epidemiological investigations
4. Conduct environmental epidemiological issues
5. Explain current environmental epidemiological issues
6. Calculate, interpret and present epidemiologic data

COURSE CONTENT

1.0 Methods of epidemiology

1.1 Descriptive studies: Geographical studies, age and sex, occupation

1.2 Analytical studies: Case-control and cohort studies

1.3 Experimental studies

1.4 Administration of an epidemiological investigation:

1.4.1 Assessment of exposure (Exposure and dose, combined exposure – physical and chemical interactions, qualitative assessment of exposure, environmental assessment of exposure, personal sampling, biological assessment of exposure, assessment of biological environment, inter-individual and group variability in exposure – population at risk, outdoor / indoor exposure and time – weighted exposure);

1.4.2 Health effects, their measurements and interpretation (Mortality and morbidity statistics):

1.4.2.1 Cancer and environmental factors

1.4.2.2 Respiratory and cardiovascular effects,

1.4.2.3 Effects on nervous system and organs of sense,

1.4.2.4 Behavioural effects,

1.4.2.5 Haemopoieric effects,

1.4.2.6 Effects on the musculoskeletal system and growth,

1.4.2.7 Effects on skin, reproductive effects

1.4.2.8 Effects on other major internal organs;

1.4.2.9 Planning; organisation; execution evaluation and feedback.

2.0 Counting diseases

2.1 Incidence rates

2.2 Prevalence rates

2.3 Birth and death rates

2.4 Special mortality rates

2.5 Special rates

2.6 Comparison of rates

3.0 Samples

3.1 Sample size: Binary data, quantitative data and choice of sample size

3.2 Sampling methods: Simple random sampling, multi-stage sampling, stratified sampling and choice of sampling method

3.3 Some important epidemiological variables and attributes

3.4 Host determinates: Age, ethics group, marital status, family structure, socio-economic status , occupation and habits

3.5 Agent determinates: Pathogenicity, dosage and infectivity

3.6 Environmental determinates: Climate, place, time, movement, vector ecology and availability of food

4.0 Records

4.1 Field survey records:

4.1.1 Personal identity, number of items, sequence of items, layout and coding

4.1.2 Interview or questionnaire forms

4.1.3 Hospital or clinic records

4.2 **Special types of records:** Computer records, tape-records, dairies, logbooks and registers, photographs and other records

4.2.1 Record linkage

4.2.2 Transport and storage of records

5.0 **Fieldwork techniques**

5.1 **Planning:** Timing of a survey

5.2 **Organization:** Community collaboration and selection of personnel

5.3 **Execution:** Supervision

6.0 Analysis and presentation of findings

6.1 Analysis: Binary data, quantitative data and correlation standardization

6.2 Presentation of findings: Written reports, tabulation, line diagrams, histograms, bar diagrams, pie diagrams and maps

7.0 Investigation of epidemics

7.1 Infectious disease epidemics **7.2**

Verification of the diagosis:

7.2.1 Confirmation of the existence of an epidemic

7.2.2 Identification of affected persons and their characteristics

7.2.3 Definition and investigation of the population at risk

7.2.4 Formulation of a hypothesis as to source and spread of epidemic

7.2.5 Management of the epidemic

7.2.6 Experimental verification of agents of disease and mode of spread and literature search

8.0 Surveillance

9.0 Notification

10.0 Uses of epidemiology information

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations

NOTIONAL HOURS: 80 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Field work: 1 hour per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED BOOKS

1. Ray M. (2011)**. Fundamentals of Epidemiology and Biostatistics: Combining the Basics.** Singapore: Johns and Bartlett Learning

RECOMMENDED BOOKS

1. Michael D., Nancy F., et al (2015). **Behavioural epidemiology principles and applications**. Singapore: Johns and Barlett publishers
2. Merill M. (2011) **Principles of epidemiology workbook**. Singapore: Johns and Barlett Publishers.

COURSE TITLE: PROJECT PLANNING, MONITORING & EVALUATION
COURSE CODE: EHS 522

INTRODUCTION

The course is designed to develop a basic understanding of the purposes, processes, norms, standards and guiding principles for planning, monitoring and evaluation within the contextual framework of development. Good planning, monitoring and evaluation can help an organisation extract relevant information from past and ongoing activities that can be used as a basis for programmatic fine-tuning, re-orientation and future planning. Without effective planning, monitoring and evaluation, it would be impossible to judge if work is going in the right direction, whether progress or success can be claimed, and how future efforts be improved

COURSE AIM

The course aims at equipping students with knowledge, skills and attitude on the development of robust results framework for public health projects and programmes, with clear indicators, baselines and targets; and setting up monitoring system.

COURSE OBJECTIVES

1. Define the key terms and concepts
2. Describe the term Project
3. Describe the common terms used in project management
4. Describe the project life cycle
5. Explain the project triangle (boundaries)
6. Outline the significance of projects to society
7. Discuss the role of the project manager
8. Describe the steps used in project proposal writing
9. Give an account of the qualities of a project manager
10. Outline the processes involved in project implementation phase
11. Discuss the importance of leading and inspiring the project team.
12. Outline the process of monitoring and evaluating the project positively.

COURSE LEARNING OUTCOMES

1. Demonstrate the understanding of the basic concepts of project cycle and project planning cycle.
2. Develop skills in developing project ideas using appropriate methodology.
3. Design a project using Logical Framework Analysis (LFA)
4. Appraise the project using appropriate appraisal techniques.
5. Demonstrate the understanding of the process of implementing a project.
6. Demonstrate the understanding of the concept of monitoring and evaluation of projects.
7. Use skills to monitor and evaluate developmental projects and programmes

COURSE CONTENT

1.0 **Introduction**

1.1 Definition of the terms 'Project, Planning, Benchmarking, TQM.
1.2 Characteristics of the project
1.3 Ancient Versus Contemporary (Modern) Projects

2.0 **Project Planning**

2.1 Concept of project and project cycle
2.2 Concept of project planning and project planning cycle
2.3 Generation of project idea
2.4 Environment scanning for project idea
2.5 Sources of project ideas
2.6 Preliminary screening of project ideas
2.7 Project rating index

3.0 Project Feasibility Analysis

3.1 Economic and financial feasibility
3.2 Technical and managerial feasibility
3.3 Environmental feasibility

4.0 Project Planning and Design Process Logical Framework Analysis (LFA)

4.1 Concept of LFA
4.3 Stakeholder Analysis
4.4 Problem Tree and objectives tree analysis
4.5 Analysis of strategies
4.6 Fixing project output and activity
4.7 Assumptions and risks Monitoring and evaluation indicators

5.0 Project Appraisal

5.1 Concept and Process

5.2 Appraisal Techniques
5.3 Discounted and non-discounted cash flow techniques
5.4 Social – cost benefits analysis and analysis of risk

6.0 Project Implementation Planning:
6.1 Concept and Need for project implementation planning
6.2 Pre-requisites for project implementation
6.3 Process of project implementation planning
6.4 Tracking, controlling and reporting changes
6.5 Networking techniques for project implementation development of project network
6.6 Dealing with risks
6.7 CPM model – Project review and control.

7.0 **Project Monitoring**
7.1 Need for project monitoring
7.2 Indicators of monitoring
7.3 Process and outcome monitoring
7.4 Designing a monitoring system 7.5 Project management information.

8.0 **Project Evaluation**
8.1 Types of evaluation - Internal, External, Self-process, Outcome and impact evaluation
8.2 Approaches to evaluation – Developing Indicators, Measuring Costs - Evaluation benefit
8.3 Lessons learnt

9.0 **Participatory Monitoring and Evaluation**
9.1 Need for participatory Monitoring and Evaluation
9.2 Difference between conventional and Participatory Evaluation
9.3 Monitoring and Evaluation Methods and Tools
9.4 Designing Participatory Monitoring Systems and Evaluation Framework

10.0 Leadership in Project Team
10.1The concept Team
10.2 Role of the leader in the team
10.3 Team dynamics
10.4 Matrix Working
10.5 Situational Leadership style
10.6 Effective Communication
10.7 Managing Oneself, then the Project

11.0 Field Study and Reporting

11.1 Developing a format for project monitoring and evaluation
11.2 Monitoring of an on-going project
11.3 Evaluation of a completed Projected

12.0 Practical demonstration of project management software

TEACHING METHODS
1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations

NOTIONAL HOURS: 90 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Field work: 1 hour per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1.0 Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
1.0 Final Examinations	**60%**
1.1 Theory	60%

PRESCRIBED READINGS

1. Albert L. (2017). **Management and Planning Control.** 7th ed. London: Elsevier press
2. Jeremie A. (2014). Practical Cost Control Handbook for Project Managers. 2nd ed. Fourth revolution publishing press

RECOMMENDED READINGS

1. Bapat, J.(2015)**Development projects and critical theory of Environment**.New Delhi: sage Publication,
2. Bapat, J.(2005)**Development Projects and Critical Theory of Environment**. New Delhi: sage Publication,

3. Gopalakrishnan. P., Ramamurthy, V.E. (2000).**Text Book of project planning and Management Cycle.** Hawaii: Fast west centre.
4. Mosse, D. (2005). **Cultivating Development**. New Delhi: Vistaar Publications.

COURSE TITLE: CLIMATE CHANGE AND DISASTER RISK REDUCTION

COURSE CODE: EHS 523

INTRODUCTION

This course seeks to impart a broad understanding of the theory, methods, tools and skills required for conducting analyses of: vulnerability and adaptation to climate variability and change (including extreme climatic events); disaster risk reduction and other environmental changes. Additionally, the course emphasizes the integration of disciplines and covers a range of subject matter, from climate science, biophysical environmental impacts to socio-economic effects.

COURSE AIM

To equip students with knowledge and skills on how to protect human health and environment from climate change and reduce disaster risk.

COURSE OBJECTIVES:

1. Explain the basic concepts of climate change science
2. Describe the anthropogenic drivers of climate change
3. Elucidate observed and projected changes in the climate system
4. Illustrate how climate change affects human health
5. Outline adaptation measures against climate change
6. Establish climate resilient health systems
7. Perform vulnerability and adaptation assessment
8. Formulate the health component of a national adaptation plan
9. Outline climate change mitigation measures
10. Describe health impact assessment process
11. Describe the stages of risk assessment for decision making

COURSE LEARNING OUTCOMES

1. Recommend appropriate measures to mitigate the main causes of global climate change and the likely impacts

2. State how climate change adaptation and mitigation are linked to disaster risk reduction
3. Conduct the participatory monitoring and evaluation of community responses to climate change and associated disasters
4. Advocate organizational changes necessary for developing climate resilient health systems
5. Demonstrate knowledge of how to access local, national and international information about climate change effects on health, relevant to adapting health services
6. Illustartes how to use information about climate change effects on health to improve decisions about health services delivery
7. Initiates and participates in collaborative learning opportunities with health and environmental professionals active in climate change management.
8. Conduct risk assessment as aid for decision making
9. Demonstrates application of this knowledge to adapt and improve health services delivery

COURSE CONTENT:

1.0 Climate Change Impacts on Human Health and the Environment.

1.1 Introduction to Climate Change Science

1.1.1 Weather and Climate

1.1.2 The Greenhouse Effect

1.1.3 Climate Change and Global Warming

1.2 Anthropogenic Drivers of Climate Change

1.3 Observed and Projected Changes in the Climate System

1.4 How Climate Change Affects Human Health

1.5 Climate Change Adaptation

1.6 Climate Change Mitigation

1.7 Building Climate Resilient Health Systems

2.0 Disaster Risk Reduction

2.1 Environmental Health and disasters

2.2 Disasters and emergencies

2.2.1 Droughts

2.2.2 Floods

2.2.3 Hurricanes

2.3 The effects of disasters on Environmental Health facilities and services

2.4 Vulnerability to disasters and emergencies

2.5 Human actions that increase vulnerability to disasters

2.6 Relief actors and their role in disaster risk reduction

2.7 The disaster-management cycle

2.8 Steps in disaster management

2.8.1 Vulnerability assessment

2.8.2 Prevention and mitigation

2.8.3 Emergency preparedness

2.8.4 Planning, policy and capacity building

2.8.5 Emergency response

2.8.6 Rehabilitation, reconstruction and recovery

2.9 Environmental health activities during disasters and emergencies

2.9.1 Shelter and emergency settlements

2.9.2 Water supply

2.9.3 Sanitation

2.9.4 Food safety

2.9.5 Vector and pest control

2.10 The structure of the Disaster Management System in Zambia

3.0 **Disaster Risk Assessment**

3.1 Definition of Disaster Risk Assessment

3.2 Purpose and scope of Risk Assessment

3.3 Episodes and activities in relation to the risks and occurrence of sudden disasters

3.4 Decision making scenarios

3.5 The Process of Risk Analysis

3.6.1 Assessing the hazard

3.6.2 Assessing vulnerability

3.6.3 Assessing manageability

3.6.4 Quantifying the risk

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations

NOTIONAL HOURS: 100 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Field work: 2 hours per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS

1. Intergovernmental Panel on Climate Change (2014) **Climate Change 2014: Impacts, Adaptation, and Vulnerability**, Cambridge University Press, Cambridge, United Kingdom.
2. World Health Organisation (2015) **Operational Framework for Building Climate Resilient Health Systems**, WHO Press, Geneva, Switzerland.
3. World Health Organisation (2002) **Environmental Health in Emergencies and Disasters**, WHO Press, Geneva, Switzerland.

RECOMMENDED READINGS

1. Intergovernmental Panel on Climate Change (2014) **Climate Change 2014: Mitigation of Climate Change**, Cambridge University Press, Cambridge, United Kingdom.
2. WHO (2003) **Climate Change and Human Health - Risks and Responses**, WHO Press, Geneva, Switzerland.
3. World Health Organisation (2013) **Protecting Health from Climate Change: Vulnerability and Adaptation Assessment**, WHO Press, Geneva, Switzerland

COURSE TITLE: ENVIRONMENTAL HEALTH ADMINISTRATION AND FINANCIAL MANAGEMENT

COURSE CODE: EHS 524

INTRODUCTION

The course provides relevant skills that enable students to apply fundamental principles of change management in managing environmental health/public health policies, managing financial resources and their implementation in health sector administration.

COURSE AIM

To enable students appreciate the moral and ethical dimensions of public health action and how to address them.

COURSE OBJECTIVES

1. Outline the principles of public health laws
2. Describe the process of change management
3. Discuss the management and administration of financial and material resources. 4. Elucidate the linkage between sustainable development and public health

COURSE LEARNING OUTCOMES

1. Manage health care organisations
2. Manage change in healthcare organisations

COURSE CONTENT

1. Health management

1.1. Health systems development, health policy planning and health systems financing and provision
1.2. Local government structure in relation to health and environment.
1.3. Management styles (supervision) and organization culture.
1.4. Team building and group dynamics.
1.5. Providing and receiving summaries.
1.6. Managing a meeting.
1.7. Making presentations.
1.8. Proposal writing.
1.9. Negotiation skills, including analysis of power structures in meetings.
1.10. Conflict management with emphasis on staff conflicts.
1.11. Leadership in organizational change and change management.
1.12. Human resource development: Planning staff needs and performance appraisal.
1.13. Capacity building in communities and local institutions

2. Office routine

2.1. Organisation and filing systems
2.2. Record of incoming and outgoing mail
2.3. Complaints register
2.4. Infectious disease register
2.5. Staff register and records
2.6. Routine reporting: Daily, weekly, monthly, quarterly, biannual and annually
2.7. Uniforms and personal issue register
2.8. Income and expenditure records
2.9. Staff discipline records

3. **Financing health care and environmental management** 9.4 Financing environmental activities.
    3.1. Cost sharing, user charges, community financing – willingness to pay for water, sanitation
    3.2. Accounting (basic concepts of financial management and auditing – emphasizing direct relationship with Financial Accounting and Management Systems: FAMS)
    3.3. Procurement procedures and tendering
    3.4. Management of stores and inventories of fixed and movable assets
    3.5. Transport planning and management
    3.6. Management of buildings and equipment

4. **Economics of health care and sustainable development**
    4.1. Public and private health care financing, alternative financing schemes and financing of environmental related disease control programmes

5. **Project analysis and assessment of environmental activities**
    5.1. Costs and benefits, individual and society cost, and benefits of environmental projects
    5.2. Cost effectiveness analysis
    5.3. Impact analysis and cost utility analysis
    5.4. Change in productivity and loss of earnings methods
    5.5. Contingent and travel cost methods
    5.6. Cost benefit analysis
    5.7. Choice of a viable project

6. **Primary health care from the 50s to the 21st century**
    6.1. **The primary health care approach**
        - Introduction
        - The medical model, vertical programmes, and the basic health services model.
        - The foundations, concept of (comprehensive) primary health care and the Health for All 2000 strategy.
        - The PHC components.
        - The principles of PHC, its rationale and implications for health planning and health services organization: focus on prevention, appropriate health technology, equity, community participation, and intersectorial collaboration.
        - PHC: Community-based health care and basic health services.
        - Various interpretations of PHC.
        - Constraints to PHC

7. **Selective primary health care (SPHC)**

7.1 The development of SPHC in the 80s.

8.2 A Technical and operational critique (conceptual problems, methodological problems)
8.3 A Socio-political critique
8.4 The Bamako initiative and Harare declaration
8.5 Health for all in the 21st Century

8. Public Health and Sustainability

8.1. **Introduction**

8.1.1 Definition of terms: Public health; Sustainable development;
8.1.2 The linkage between sustainable development and public health

8.2. **Non-sustainable development**

8.2.1 Definition of non-sustainable development
8.2.2 Drivers of non-sustainable development
8.2.3 Impacts of non-sustainable development on the environment
8.2.4 Impacts of non-sustainable development on public health

8.3. **Sustainable development goals (SDGs)**

8.3.1 Scope and objectives of SDGs
8.3.2 Health related SDGs
8.3.3 Sustainable development in public health
8.3.4 Mainstreaming of SDGs in national development

TEACHING METHODS

1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations

NOTIONAL HOURS: 100 HOURS

1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Field work: 2 hours per week
5. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%
1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS

1. Abdehhadi M. (2020). **Environmental Health Management and Prevention Practice.** 1st ed. London: intechopen publishers.
2. Aditya J., Gerard Z., Starvoula L. (2018). **Managing Health and Wellbeing Ethics Responsibility and Sustainability**. 1st ed. Netherlands: springer press
3. Nancy M. (2013). **Understanding Environmental Health: How We Live In The World**. 2nd ed. Johns and Barlett Learning.

RECOMMENDED READINGS

1. Benat R., Karine W., Veronique T., (2018) **Management of Emerging Public Health Issues and Risk: Multidisplinary Approaches to the Changing Environment**. 1st ed. New York: academic press

COURSE TITLE: ENVIRONMENTAL ECONOMICS

COURSE CODE: EHS 525

INTRODUCTION

The course analyses the economic principles underlying the design of efficient environmental policies and the optimal management of natural resources. It identifies conditions under which market failures lead to environmental degradation or to the overexploitation of natural resources, and discusses economic policies that can counteract such market failures. Particular issues of interest include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming.

COURSE AIM

The course aims at providing an interdisciplinary understanding of the linkages between the economic and ecological system thereby providing students with knowledge, skills and attitude in the application of the principles of economics to the study of how environmental and natural resources are developed and managed.

COURSE OBJECTIVES

1. Define terms and concepts
2. Explain the concepts of environmental economics and their application to environmental health assessment
3. Describe the tools of economic analysis
4. Examine the relationship between economics, environment and disease
5. Explain how various market failures may lead to environmental degradation or the overexploitation of natural resources
6. Elucidate the process of conducting assessment of environmental activities
7. Describe the process of analysing existing and new projects
8. Explain the classification of pollutants using Pollution Taxonomy

COURSE LEARNING OUTCOMES

1. Conduct environmental health assessment.
2. Apply concepts of environmental economics
3. Apply tools of economic analysis in the management of the environmental resources
4. Enforce environmental policies that are aimed at improving environmental quality for public health protection
5. Conduct project and environmental activities' analysis using impact analysis tools
6. Classify pollutants using Pollution Taxonomy Concept
7. Use economic modelling to evaluate various approaches to the design of efficient environmental policies and of rules for the optimal management of natural resources
8. Construct and analyse simple dynamic models of natural resource management

COURSECONTENT

1.0 Introduction to Environmental Economics

1.1 Define terms: economics; environmental economics/natural resource economics; ecological economics;

1.2 Distinguish between health economics and environmental economics.

1.3 Why study environmental economics?

1.4 Key questions for environmental economics

1.5 Concept of development

1.6 Poverty and environment

2.0 Basic tools of economic analysis

2.1 Demand, supply, costs and opportunity costs.

2.2 Economic efficiency and effectiveness

2.3 Markets and market failure price distortions and environmental externalities.

2.4 Production function, inputs and outputs

3.0 **Economics, environment and diseases**

3.1 Economic impact of diseases

3.2 Costs of a better environment

3.3 Economic policy and environment

3.4 Environmental problems, health and productivity

3.5 Human environmental relationship

3.6 Effects of environmental activities on health

4.0 **Project analysis and assessment of environmental activities**

4.1 Costs and benefits, individual and society cost, and benefits of environmental projects.

4.2 Cost effectiveness analysis

4.3 Impact analysis and cost utility analysis

4.4 Environmental full cost accounting
4.5 Change in productivity and loss of earnings methods
4.6 Contingent and travel cost methods
4.7 Cost benefit analysis
4.8 Choice of a viable project

5.0 **Economics of Pollution Control**
5.1 Factors in determining the natural capital of a nation
5.2 Damage assessments of environmental resources
5.3 The concept of pollution taxonomy: Classification of pollutants (Absorptive capacity;
5.4 Horizontal influence; Verticalzone of influence)
5.5 Mechanisms to achieve pollution reduction (Regulatory and Incentive-based Policies)
5.5.1 Emission Standards and Emission charges
5.5.2 Command and Control Regulations
5.5.3 Pollution Rights
5.5.4 Emission Offsets
5.5.5 Banking Emissions
5.5.6 The Bubble
5.6 Control of pollution at Global Level
5.6.1 International conventions
5.6.2 International protocols
5.6.3 International treaty

TEACHING METHODS
1. Lectures
2. Tutorials
3. Group discussions
4. Field visits
5. Demonstrations
6. Presentations

NOTIONAL HOURS: 80 HOURS
1. Lectures: 3 hours per week
2. Tutorial: 1 hour per week
3. Seminar: 1 hour per week
4. Assessment and self-study: 1 hour per week

ASSESSMENT METHODS

1. Continuous assessment	**40%**
1.1 2 Tests	30%

1.2 2 Assignments	10%
2. Final Examinations	**60%**
2.1 Theory	60%

PRESCRIBED READINGS

1. Endres A. (2011). **Environmental Economics: Theory and Policy**. 1st ed. Cambridge University Press
2. Paul H. (2017). Drawn; **The Most Comprehensive Plan Ever Proposed To Global Warming**. 1st ed. New York: Elsevier press

RECOMMENDED READING

1. Stephen S. (2011). **Environmental Economics: A Very Short Story Introduction**. Oxford: Clarendon Press