COMMISSION FOR HIGHER EDUCATION

Credit Accumulation and Transfer System
Education – Secondary (Science)
Undergraduate

June 2012

CREDIT ACCUMULATION AND TRANSFER SYSTEM

EDUCATION – SECONDARY (SCIENCE)

Commission for Higher Education
Nairobi, Kenya, June 2012

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TABLE OF CONTENTS

1.0 FORWORD

In the last twenty years, Kenya has witnessed rapid expansion of university education as a result of establishment of new and private universities. Consequently, universities developed many academic programmes with some having similar contents, but taught under different names. Overtime this scenario brought challenges. Employers started to question the names and similarities associated with some programmes and secondly students could not transfer credits in the related programmes from one institution to another. This problem is common to all member states of the East African Common market.

To address this problem the Higher education regulatory bodies of East African community member states, namely Commission for Higher Education (CHE) Kenya, National Council for Higher Education (NCHE) Uganda and Tanzania Commission for Universities (TCU) started the Credit Accumulation and Transfer System (CATS) project. The project was funded by Rockefeller Foundation. During this phase of the project, minimum core requirements in Human Medicine, Engineering, Basic Sciences and Agriculture were developed. After this phase it was decided that each country proceeds with the project by developing minimum core requirements in other fields of study in higher education.

During phase two of the project in Kenya, core requirements in the field of Business Studies and Information/Computer science were developed.

Phase three of the project comprised the development of core requirements in the field of Education. Experts from the universities that offer Bachelor of Education degree programmes were invited by the Commission to develop the minimum core requirements .Universities offering these programmes are expected to implement them and to provide feedback to the Commission for further refinements.

The Commission is committed to CATS project in the development of minimum core requirements in the various fields of study offered by higher education institutions in the country. The objective of the CATS project is to facilitate the mobility of students within institutions and ensure programme integration and harmonization of higher education landscape in Kenya and to serve as input into the National Qualifications Framework. The success of CATs project in Kenya is dependent on the cooperation between the Universities offering the fields of study and the Commission for Higher Education for coordination.

Prof Everett M Standa,MBS
Commission Secretary/CEO
Commission for Higher Education
Nairobi. Kenya

2.0 INTRODUCTION

The Bachelor of Education science programme is designed to produce qualified and competent science teachers for secondary schools in Kenya and beyond. It is planned in line with the requirements of the current secondary school curriculum in Kenya. The programme is practical oriented in nature, in keeping with the practical and vocational thrust of the current education system.

Group Members

	Name	*Institution*
1.	Prof. Ruth Otunga	Chepkoilel University College,
2.	Prof. William Toili	Masinde Muliro University of Science and Technology
3.	Dr. Harriet W. Njui	Daystar University
4.	Dr. Isaac Kithyo	Moi University
5.	Dr. Benard Kivunge	Kenyatta University
6.	Dr. Lusweti Kituyi	Chepkoilel University College
7.	Dr. Andrew Yasindi	Egerton University
8.	Mr. Peter M. Muriithi	Egerton University

2.1 RATIONALE OF THE PROGRAMME

The B. Ed. (science) programme is anchored on the premise that every country should have competent and professionally qualified science teachers. This underscores the need for teachers who are highly motivated, critical and innovative in responding to emerging issues in a dynamic society.

The major role of university education is to develop the relevant human resource to propel the education sector in accordance with the country's social and economic goals. The B.Ed. (science) programme should therefore equip students with relevant knowledge, skills, values and attitudes to meet the country's human resource needs.

2.2 OVERALL GOAL OF THE PROGRAMME

The programme is intended to train competent science teachers, who are capable of conducting research, mentoring students, managing educational institutions and rendering community service.

2.3 PROGRAMME LEARNING OUTCOMES

By the end of the programme, the learner should be able to:

1) Plan, utilize and manage resources in learning institutions;
2) Design, develop, implement and evaluate curricula;
3) Identify and evaluate the various foundations of Education;
4) Use relevant and appropriate teaching methods;
5) Plan and implement appropriate programmes for different categories of learners;
6) Teach science subjects effectively in the areas of specialization;
7) Apply the appropriate techniques in teaching science; and
8) Articulate and apply scientific principles to solve problems.

2.4 ADMISSION REQUIREMENTS

To obtain admission into this course, an applicant must satisfy one of the following requirements:

- Be a holder of K.C.S.E certificate or its equivalent with a minimum aggregate of C+ and a minimum grade of C+ in the two teaching subjects; or
- Be a holder of Kenya Advanced Certificate of Education (K.A.C.E) certificate with a minimum of two principle passes and one subsidiary pass , and a minimum of a principle pass in each of the two teaching subjects; or
- Be a holder of a Diploma in science education from institutions recognized by C.H.E. For those who attained a credit pass and above, they may be admitted at second year of study while those with a pass will be admitted at first year.

Students are expected to take two teaching subjects according to the subject combinations approved by the Ministry of Education.

2.5 PROGRAM DURATION AND STRUCTURE

Definitions

For purposes of this programme, the following definitions apply:

- *Lecture hour*: A lecture hour is equivalent to one (1) contact hour of lecture or two (2) hours of tutorial or three (3) hours of practical work.
- *Credit hour*: A credit hour is equivalent to one (1) lecture hour per week for a minimum of fifteen (15) weeks of teaching.
- *Course unit*: A course unit is equivalent to three (3) credit hours which is equivalent to forty five (45) lecture hours.
- *School term:* Is as defined by the Ministry of Education.

2.6 DURATION OF THE PROGRAMME

The programme shall be offered in terms of units. The minimum number of course units for the programme is 51, which is equivalent to 153 credit hours including teaching practice which is equivalent to 2 units (6 credit hours). Each university will define its common units.

The following tables give the distribution of units by regular students and those majoring in one subject area;

REGULAR STUDENTS						
Level	**Number of Core Units**				Credit hours	Lecture hours
	Education	Teaching Subject 1	Teaching Subject 2	Total		
1	4	4	4	12	36	540
2	4	4	4	12	36	540
3	5	4	4	13	39	585
	Teaching Practice			2	6	90
4	4	4	4	12	36	540
Total	**19**	**16**	**16**	**51**	**153**	**2295**

STUDENTS MAJORING IN ONE SUBJECT*						
Level	**Number of Core Units**				Credit hours	Lecture hours
	Education	Teaching Subject 1	Teaching Subject 2	Total		
1	4	4	4	12	36	540
2	4	4	4	12	36	540
3	5	6	2	13	39	585
	Teaching Practice			2	6	90
4	4	6	2	12	36	540
Total	**19**	**20**	**12**	**51**	**153**	**2295**

***Students taking this option must fulfill the Ministry of Education minimum units requirement.**

2.7 CREDIT TRANSFER

- To qualify for transfer from one university to another, a student must have attained at least a cumulative grade C or GPA of 2.0 on a GPA scale of 1 to 4.
- Credit transfer can only be granted to a registered student in the university he or she is transferring from.
- The student records will officially be communicated between the universities.
- Where a transfer is granted, the student must take a minimum of 52% of the units at the university they will graduate from.
- The student must undertake teaching practice under the university he or she intends to graduate from.
- The student must undertake all third year and fourth year courses in the university he or she intends to graduate from.
- Where a student is to transfer a course with a pre-requisite, such a pre-requisite must have been covered at the university where the student is transferring from.

- The student will be required to transfer all the credits attained at the university where he or she is transferring from.

2.8 TEACHING METHODS

The following are suggested teaching methods that could be applied to the Education programme:

Lecture, lecture-discussion, demonstration/modeling, panel of experts, case studies, discussion, discovery learning, brainstorming, co-operative learning, role play, small group discussion, problem-solving, heuristic method, experimentation, simulation, group work, directed reading, research, practicum, excursions/site visits/field trips, tutorials, internet search, project

2.9 GRADING OF COURSES

Each unit is graded out of 100 marks and the pass mark shall be 40%. The continuous assessment tests (CATs) marks will contribute 30% and the final examination will contribute 70%. For courses with a practical component, the marks will be distributed as follows: 10% practical, 20% written CATs & Assignments and 70% final examination. The minimum number of practical sessions will be 5 per unit while the minimum number of written CATs will be 2 per unit.

The marks are translated into letter grades and GPA as follow:

Mark	**Grade**
70% and above	A
60% to < 70%	B
50% to < 60%	C
40% to < 50%	D
Below 40%	F

2.10 AWARDING OF THE DEGREE

The minimum course units required for graduation are fifty one (51) including teaching practice which is equivalent to a total of 153 credit hours.

2.11 DEGREE CLASSIFICATION

The Bachelor of Education (Science) degree shall be classified depending on the overall average mark. The overall average mark will be truncated to a whole number. The classification will be as follow:

Overall Average Mark	Degree Classification	G.P.A
70% and above	First Class Honours	3.70 – 4.00
60% to < 70%	Second Class Honours (Upper Division)	3.00 - 3.69
50% to < 60%	Second Class Honours (Lower Division)	2.50 - 2.99
40% to < 50%	Pass	2.00 - 2.49

3.0 PROGRAMME/EXPECTED LEARNING OUTCOMES MATRIX

Expected Programme Learning Outcomes	YEAR 1	YEAR 2	YEAR 3	YEAR 4
	Courses	**Courses**	**Courses**	**Courses**
1. Utilize the various foundations of Education	• History and Philosophy of Education • Sociology of Education and Comparative Education			
2. Plan and implement appropriate programmes for different categories of learners	• Educational Psychology • Health Education	• Human Growth and development • Educational Guidance and Counseling		
3. Design, develop, implement and evaluate curricula		• Curriculum Development	• Educational Measurement and Evaluation	
4. Apply appropriate teaching methods		• General Teaching Methods	• Subject Methods *(Two teaching subjects)*	• Teaching Practice *(This is a field course that is equivalent to 2 courses)*
5. Plan, utilize and manage resources in			• Educational Media, Communicatio	• Educational Policy and

learning institutions			n & Technology • Research Methods in Education	Management • Planning and economics of Education • Environmental Education • Entrepreneurship Education

Programme Learning Outcomes	**YEAR 1**		**YEAR 2**	
	Courses	Credit units	Courses	Credit Units
6) Teach science subjects effectively in the areas of specialization	• Invertebrate Zoology • General Botany • Vertebrate Zoology • General Genetics • Fundamentals of Chemistry • Introduction to Organic Chemistry • Introduction to Analytical Chemistry • Organic Chemistry • Introduction to Geography • Environmental Geography • Cartography & Map analysis • Physical Geography 1 • Basic Maths and Analytic Geometry • Differential Calculus • Introduction to probability and statistics • Linear Algebra I • Mechanics • Heat and thermodynamics • Geometrical optics	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	• General Ecology • Systematics and Taxonomy of Plants • Developmental Biology • General Microbiology • Atomic Structure & Bonding • Introduction to Chemical Kinetics & Thermodynamics • Chemical Analysis & Structural Determination • Chemical Thermodynamics & Phase Equilibria • Human Geography 1 • Geography of East Africa • Physical Geography 2 • Human Geography 2 • Integral Calculus • Real Analysis I • Ordinary differential Equations I • Complex Analysis I • Waves and oscillations. • Electricity and Magnetism	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3

	• Introduction to Quantum Physics.	3 3 3	I • Quantum Mechanics • Electricity and Magnetism II	3 3 3 3 3
7) Apply the appropriate techniques in teaching science	• Invertebrate zoology • General Botany • Vertebrate zoology • General Genetics • Fundamentals of Chemistry • Introduction to Organic Chemistry • Introduction to Analytical Chemistry • Organic Chemistry • Introduction to Geography • Environmental Geography • Cartography & Map analysis • Physical Geography 1 • Basic Maths and Analytic Geometry • Differential Calculus • Introduction to probability and statistics • Linear Algebra I • Mechanics • Heat and thermodynamics • Geometrical optics • Introduction to		• General Ecology • Systematics and taxonomy of plants • Developmental Biology • General microbiology • Atomic Structure & Bonding • Introduction to Chemical Kinetics & Thermodynamics • Chemical Analysis & Structural Determination • Chemical Thermodynamics & Phase Equilibria • Human Geography 1 • Geography of East Africa • Physical Geography 2 • Human Geography 2 • Integral Calculus • Real Analysis I • Ordinary differential Equations I • Complex Analysis I • Waves and Oscillations • Electricity and Magnetism	 3 3 3

	Quantum Physics		I • Quantum Mechanics • Electricity and Magnetism II	
8) Articulate and apply scientific principles to solve problems	• Invertebrate zoology • General Botany • Vertebrate Zoology • General Genetics • Fundamentals of Chemistry • Introduction to Organic Chemistry • Introduction to Analytical Chemistry • Organic Chemistry • Introduction to Geography • Environmental Geography • Cartography & Map analysis • Physical Geography 1 • Basic Maths and Analytic Geometry • Differential Calculus • Introduction to probability and statistics • Linear Algebra I • Mechanics • Heat and thermodynamics • Geometrical Optics • Introduction to Quantum Physics		• General Ecology • Systematics and Taxonomy of Plants • Developmental Biology • General microbiology • Atomic Structure & Bonding • Introduction to Chemical Kinetics & Thermodynamics • Chemical Analysis & Structural Determination • Chemical Thermodynamics & Phase Equilibria • Human Geography 1 • Geography of East Africa • Physical Geography 2 • Human Geography 2 • Integral Calculus • Real Analysis I • Ordinary differential Equations I • Complex Analysis I • Waves and oscillations • Electricity and Magnetism I • Quantum Mechanics • Electricity and Magnetism II	3 3 3

Programme learning Outcomes	YEAR 3		YEAR 4	
	COURSES	Credit unit	**COURSES**	Credit Unit
6) **Teach science subjects effectively in the areas of specialization**	• Plant Physiology & Biochemistry • Cell Biology • Animal physiology • Biostatistics • Chemistry of s-and p-Block Elements • Organic Synthesis • Co-ordination Chemistry • Heterocyclic and Stereochemistry • Air Photo Interpretation & research Methods in Geography • Remote Sensing & Resource Management • Geographical Information Systems (GIS) • Senior Projects • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Atomic Physics • Properties of matter • Physical Optics • Electronics	3 3 3 3 3 3 6 3 3 3 3 3 3 3 3 3 3 3 3 3 3	• Parasitology & Immunology • Plant Pathology • Evolutionary Biology • Molecular and Microbial genetics • Transition Metal Chemistry • Industrial Chemistry Environmental Chemistry Electrochemistry • Quantitative Techniques & Computer-Aided Data Analysis • Climatology • Geography of Tourism and Recreation • Agricultural Geography • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Nuclear Physics • Solid State Physics • Electromagnetic theory • Environmental and renewable energy physics	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
7) **Apply the appropriate techniques in teaching science**	• Plant Physiology & Biochemistry	6	• Parasitology & Immunology	

	• Cell Biology • Animal physiology • Biostatistics • Chemistry of s-and p-Block Elements • Organic Synthesis • Co-ordination Chemistry • Heterocyclic and Stereochemistry • Air Photo Interpretation & research Methods in Geography • Remote Sensing & Resource Management • Geographical Information Systems (GIS) • Senior Projects • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Atomic Physics • Properties of matter • Physical Optics • Electronics	3 3 3 6	• Plant Pathology • Evolutionary Biology • Molecular and Microbial genetics • Transition Metal Chemistry • Industrial Chemistry • Environmental Chemistry • Electrochemistry • Quantitative Techniques & Computer-Aided Data Analysis • Climatology • Geography of Tourism and Recreation • Agricultural Geography • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Nuclear Physics • Solid State Physics • Electromagnetic theory • Environmental and renewable energy physics	
8) **Articulate and apply scientific principles to solve problems**	• Plant Physiology & Biochemistry • Cell Biology • Animal physiology • Biostatistics • Chemistry of s-and p-Block Elements • Organic Synthesis. • Co-ordination Chemistry • Heterocyclic and Stereochemistry • Air Photo Interpretation & research Methods in	3 3 3 3 3 3 3	• Parasitology & immunology • Plant Pathology • Evolutionary Biology • Molecular and Microbial genetics • Transition Metal Chemistry • Industrial Chemistry • Environmental Chemistry • Electrochemistry • Quantitative Techniques & Computer-Aided Data	3 3 3 3 3 3 3 3

	Geography • Remote Sensing & Resource Management • Geographical Information Systems (GIS) • Senior Projects • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Atomic Physics • Properties of Matter • Physical Optics • Electronics	 3 3 3 3 3 3 3 3 3 3 3	Analysis • Climatology • Geography of Tourism and Recreation • Agricultural Geography • Math Elective 1 • Math Elective 2 • Math Elective 3 • Math Elective 4 • Nuclear Physics • Solid State Physics • Electromagnetic theory • Environmental and Renewable Energy Physics	3 3 3 3 3 3 3 3

4.0 PROGRAMME COURSES

LEVEL	SUBJECT	COURSE	CREDIT UNITs
1	**EDUCATION**	• Educational Psychology • History & Philosophy of Education • Sociology of Education & Comparative Education • Health Education	**3** **3** **3** **3**
	BIOLOGY	• General Botany • Invertebrate Zoology • Vertebrate Zoology • General Genetics	**3** **3** **3** **3**

	CHEMISTRY	• Fundamentals of Chemistry • Introduction to Organic Chemistry • Introduction to Analytical Chemistry • Organic Chemistry	**3** **3** **3** **3**
	GEOGRAPHY	• Introduction to Geography • Environmental Geography • Cartography & Map Analysis • Physical Geography 1	**3** **3** **3** **3**
	MATHEMATICS	• Basic Mathematics & Analytic Geometry. • Differential Calculus • Introduction to Probability and Statistics • Linear Algebra I	**3** **3** **3** **3**
	PHYSICS	• Mechanics • Heat and Thermodynamics • Geometrical Optics • Introduction to Quantum Physics	**3** **3** **3** **3**
2	**EDUCATION**	• Human Growth and Development • Curriculum Development • Educational Guidance and Counseling • General Teaching Methods	**3** **3** **3** **3**
	BIOLOGY	• General Ecology • Systematics and Taxonomy of Plants • Developmental Biology • General Microbiology	**3** **3** **3** **3**
	CHEMISTRY	• Atomic Structure & Bonding • Introduction to Chemical Kinetics and Thermodynamics. • Chemical Analysis & Structural Determination • Chemical Thermodynamics & Phase Equilibria	**3** **3** **3** **3**

	GEOGRAPHY	• Human Geography 1 • Geography of East Africa • Physical Geography 2 • Human Geography 2	**3** **3** **3** **3**
	MATHEMATICS	• Integral Calculus • Real Analysis I • Ordinary differential Equations I • Complex Analysis I	**3** **3** **3** **3**
	PHYSICS	• Waves and Oscillations • Introduction to Electricity and Magnetism • Electricity and Magnetism • Quantum Mechanics	**3** **3** **3** **3**
3	**EDUCATION**	• Educational Media, Communication and Technology • Research Methods in Education • Subject Methods 1 • Subject Methods 2 • Educational Measurement and Evaluation • Teaching Practice	**3** **3** **3** **3** **3** **3**
	BIOLOGY	• Plant Physiology & Biochemistry • Cell Biology • Animal Physiology • Biostatistics	**3** **3** **3** **3**
	CHEMISTRY	• Chemistry of s-and p-Block Elements • Organic Synthesis • Co-ordination Chemistry • Heterocyclic & Stereochemistry	**3** **3** **3** **3**
	GEOGRAPHY	• Air Photo Interpretation & Research Methods in Geography • Remote Sensing & Resource Management • Geographical Information Systems (GIS) • Senior Projects	**3** **3** **3** **3**
		PURE / APPLIED / **STATISTICS**	

	MATHEMATICS*	• Real Analysis II • Group theory • Ring theory • Linear algebra II • Algebraic structures. • Number theory	• Real Analysis II • Numerical Analysis I • ODE II • Dynamics • Analytic applied Mathematics • Fluid Mechanics	• Multivariate probability distributions. • Theory of estimation. • Operations research • Tests of Hypothesis • Sample survey • Quality Control methods	**3 credits per course**
	PHYSICS	• Atomic Physics • Properties of Matter • Physical Optics • Electronics			**3** **3** **3** **3**
4	**EDUCATION**	• Educational Policy and Management • Planning and Economics of Education • Environmental Education • Entrepreneurship in Education			**3** **3** **3** **3**
	BIOLOGY	• Parasitology & Immunology • Plant Pathology • Evolutionary Biology • Molecular and Microbial genetics			**3** **3** **3** **3**
	CHEMISTRY	• Transition Metal Chemistry • Industrial Chemistry • Environmental Chemistry • Electrochemistry			**3** **3** **3** **3**
	GEOGRAPHY	• Quantitative Techniques & Computer-Aided Data Analysis • Climatology • Geography of Tourism and Recreation • Agricultural Geography			**3** **3** **3** **3**
		PURE	APPLIED	**STATISTICS**	

	MATHEMATICS*	• Topology • Field theory • Galois theory • Complex analysis II • Functional Analysis • Measure theory & integration • Coding theory	• Numerical Methods • Differential Geometry • PDE • Fluid flow analysis • Methods of fluid mechanics • Complex analysis II	• Stochastic processes • Design and analysis of experiments • Multivariate methods • Measure & probability • Systems analysis & design. • Time series analysis	**3** **3** **3** **3** **3** **3**
	PHYSICS	• Nuclear Physics • Solid state Physics • Electromagnetic theory • Environmental and Renewable Energy Physics			**3** **3** **3** **3**

*** At levels three and four, students taking Mathematics should choose four courses in their line of specialization.**

5.0 COURSE DESCRITIONS

5.1 EDUCATION COURSES

LEVEL 1

EDUCATIONAL PSYCHOLOGY 3 Credit Hours

Course Purpose

To introduce students to different stages of human development and their relation to education

Expected Learning Outcomes

1. At the end of this course, students should be able to:
2. Explain the role of psychology in education;
3. Discuss different developmental stages and their implication to education; and
4. Explain theories in psychology and their relationship to education.

Course Content

General human development; adolescence stage; Biological, social and cultural factors affecting human development; theories of learning; motivation; retention; and transfer of learning

Learning and Teaching Methods

Lectures, Discussions

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

David Messer (2000). Masterly Motivation in Early childhood education, Rout ledge.

Eggen, P. and Kauchak, D. (2003). Education psychology, Prentice Hall.

Mwamwenda, T. (1995). Education Psychology (2nd Ed). McGraw Hall publishers.

HISTORY AND PHILOSOPHY OF EDUCATION 3 Credit Hours

Course Purpose

To understand and appreciate the historical and philosophical foundations of education

Expected Learning Outcomes

At the end of this course, Students should be able to:

1. Explain the role of history in education;
2. Identify the key players in the development of education;
3. Relate history of education to the present theory and practice in education;
4. Explain the relationship between philosophy and education;
5. Explain the need for a national philosophy of education; and
6. Discuss the different schools of philosophy and their impact on education.

Course Content

Development of education in historical perspective; the emergency of states and influence on the development of education; education in the 19th and 20th centuries; study of selected educational thinkers; history of education in Kenya: pre-colonial to the present.

Introduction to philosophy of education; Values and education; education and democracy; philosophical foundation of education; application of philosophical theories to education; development of a national philosophy of education; the contribution of re-known philosophers to education

Learning and Teaching Methods

Lectures, discussions

Course Assessment

Type	Weighting
Examination	70%
Continuous assessment tests	30%
Total	100%

Course Texts

Brightman, S. (1951). Doing philosophy, Renehart and Winston,

Brubacher, B .(1962). Philosophy and Education. Unwim publishers.

Durkheim E. (1951). Moral Education, Longman,

Curtis, J. (1968). Short history of Educational ideas, University tutorial press.

Mayer, F. (1973). A history of Educational thought. McGraw hill publishers.

Sifuna, D. and Otiende, J. (1994). An Introductory History of Education: Nairobi: University of Nairobi Press.

SOCIOLOGY OF EDUCATION AND COMPARATIVE EDUCATION

3 Credit Hours

Course Purpose

To equip students with knowledge on relationship between education and society for them to be able to compare different education systems in the world

Expected Learning Outcomes

At the end of this course, students should be able to:

1. Explain the development of sociology of education;
2. Compare education systems from different parts of the world;
3. Acquire those skills and knowledge which are helpful to him/her in their adjustment to social situations;

4. Utilize the forces operating in social life with a view to developing capacity for social development.

Course Content

School and society; sociology and sociology of education; socialization process and education; Sociological theories of education; social stratification and education; sociology of school and classroom; sociological process and peer pressure; Meaning and development of comparative education; Education in Britain, USA, France, South Africa and Kenya

Learning and Teaching Methods

Lecturers, Discussions

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Ansu Datta ( ). Education and society, sociology of African Education. Macmillan.

Ayot, H, ( ). Sociology of Education. Nairobi: Kenyatta University press.

Kombo, D. Sociology of Education. Ad Printers Publishers.

Bogonko, S. N. & Sifuna, D. N. (1980). A History of Education in Kenya. Nairobi: KLB.

HEALTH EDUCATION 3 Credit Hours

Course Purpose

To expose students to issues in health education.

Expected Learning outcomes

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

1. Describe the human anatomy;
2. Explain the prevalent communicable diseases in East Africa and their control;
3. Describe the general principles of physical health;
4. Describe health and nutrition, sports and family planning.

Course content

Foundations of health education; human anatomy; human organ system and interdependence; significant disorders and care; prevalent communicable diseases and their control; emergency treatment; general principles of physical and mental health; Health and nutrition; sports in school environment; family planning and population control, Health education in East Africa.

Learning and Teaching Methods

Lectures, directed reading, practical demonstrations and group work.

Instructional Material and/or Equipment

Textbooks, chalkboard, handouts, computer based tools, LCD and overhead projectors

Course Assessment

Type	Weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Course texts

Isobel Kleinman (2009). Complex Physical education Plans for Grades 5 to 12. 2nd Ed.

Thomas Butler (2000). Principles of Health Education and Health Promotion. (Wadsworth's Physical Education Series).

LEVEL TWO

HUMAN GROWTH AND DEVELOPMENT 3 Credit Hours

Course Purpose

To equip students with knowledge about human growth and development

Expected Learning Outcomes

At the end of this course, students should be able:

1. Conceptualize human growth and development;
2. Explain the factors influencing growth and relationship with development;
3. Explain the concept of individual rate of growth and development.

Course Content

General concepts of human development; adolescent development: biological, social, cultural and ecological; relationship between growth, development and education; theories of human growth and development, cultural and environmental aspects of human growth and development

Learning and Teaching Methods

Lecture method, discussion, research.

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100 %

Course Texts

Crait, G. J. (1996). Human development. 4th Ed. New Jersey: Eaglewood Cliff.

Rice, P. (1992). Human development: A lifespan approach.

CURRICULUM DEVELOPMENT 3 Credit Hours

Course Purpose

To equip teachers with the knowledge to design, develop and implement school curriculum.

Expected Learning Outcome

At the end of this course, students should be able to:

1. Explain the meaning of curriculum;
2. Describe the different models of curriculum design;
3. Conceptualize curriculum change and innovation;
4. Explain the meaning of curriculum evaluation; and
5. Implement curriculum in a specific subject area.

Course Content

Conceptions of Curriculum; Relationship between school, society and curriculum; foundations of curriculum; curriculum development: aims/goals/objectives, selection and organization of learning experiences, curriculum implementation and curriculum evaluation; curriculum change and innovation; curriculum designs; curriculum development in Kenya

Learning and Teaching Methods

Lecture, discussions, research, demonstration.

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Bishop, G. (1985). Curriculum Development: A Text book for students. London: MacMillan Publishing Ltd.

Beauchamp, G. A. (1975). Curriculum Theory. Wilmette IL: Kagg Printers.

Kelly, A.V. (1989). The curriculum Theory and practice.London: Paul Chepmara Publishing Ltd.

Shiundu, J. S. & Omulando S. J. (1992). Curriculum: Theory & practice in Kenya. Nairobi: Oxford University Press.

Otunga, R. N.; Barasa, P. & Odeo, I. (2011). A Handbook for Curriculum and Instruction. Eldoret: Moi University Press.

Republic of Kenya (1976). Report of the National Committee on Educational Objectives and Policies (Gachathi Rep[ort). Nairobi: Government Printer.

Republic of Kenya (1964). The Kenya Education Commission Report I & II (Ominde Report). Nairobi: Government Printer.

Republic of Kenya (1981). The Presidential Working Party on the Second

University in Kenya (Mackay Report). Nairobi: Government Printer.

Marsh, C. J. & Willis, G. (2007). Curriculum: Alternative Approaches, Ongoing Issues. (4th Ed). New Jersey: Pearson Merrill Prentice Hall.

Ornstein, A. C. & Hunkins, F. P. (2004). Curriculum, Foundations, Principles and Issues. (3rd Ed). Boston: Allyn & Bacon.

Tyler, R.. W. (1949). Basic Principles of Curriculum and Instruction. Chicago: University of Chicago Press.

Tanner, D. & Tanner, L. (2007). Curriculum Development: Theory into Practice. New Jersey: Pearson Merrill Prentice Hall.

EDUCATIONAL GUIDANCE AND COUNSELING 3 Credit Hours

Course Purpose

To create an awareness in prospective teachers the need and methods for guidance and counseling in schools

Learning Outcomes

At the end of this course, students should be able to:

1. Explain the meaning of guidance and counseling;
2. Describe the methods and strategies used for guidance and counseling in schools; and
3. Explain the significance of guidance and counseling.

Course Content

Definition of Guidance and of Counseling; significance in schools and society; methods and strategies used in guidance and counseling; identifying cases for guidance and counseling; ethics in guidance and counseling

Learning and Teaching Methods

Lectures, discussions, role play and practicum

Course Assessment

Type	Weighting
Continuous assessment Tests	30%
Examination	70%
Total	100%

Course Texts

Mutie E.K. and Ndambuki, P. (1999). Guidance and Counseling for Schools and Colleges: Nairobi: Oxford University Press.

McLeod, J. (1998). An introduction to Counseling. (2nd Ed). Open university Press.

Olu Makinde (1984). Fundamentals of Guidance and Counseling for schools and colleges: Oxford University Press. Nairobi.

Corey G. (2001). Theory and Practice of counseling and psychotherapy: Wadsworth publishers. New York

GENERAL TEACHING METHODS 3 Credit Hours

Course Purpose

To guide students in exploring different methods of teaching science subjects.

Expected Learning Outcome

At the end of this course, students should be able to:

1. Outline various theories of learning and teaching.
2. Explain the different ways in which science subjects can be taught.
3. Explain how learning outcomes can be evaluated.

Course Content

Concepts used in the teaching and learning; different methods of teaching: lecture, lecture-discussion, demonstration/modeling, panel of experts, case studies, discussion, discovery learning, brainstorming, co-operative learning, role play, small group discussion, problem-solving, heuristic method and experimentation; objectives and objective testing; different methods of evaluation; general learning theories and their application.

Learning and Teaching Methods

Lecture, demonstration, experiments and simulations

Course Assessment

Type	Weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Course Texts

Nasimbi Were (2006). Teaching Across the Curriculum. Nairobi: Strong Wall Africa.

Campe, I. F. (1983). Introduction to educational instruction. (6th Ed). London: Allyn and Bacon Inc.

Nafukho, F. N., Amutabi, M. N. & Otunga, R. N. (2005). Foundations of Adult Education in Africa. Cape Town: Pearson Education South Africa.

Otunga, R. N., Odeo, I. I. & Barasa, P. L. (2011). A Handbook for Curriculum and Instruction. Eldoret: Moi University Press.

Mukwa, C. W. & Too, J. K. (2002). General Instructional Methods. Eldoret: Moi University Press.

LEVEL THREE

EDUCATIONAL COMMUNICATION, MEDIA AND TECHNOLOGY

3 Credit Hours

Course Purpose

To introduce students to the use of media in education and expose them to the existing variety of educational resources

Expected Learning Outcomes

At the end of the course, students should be able to:

1. Define educational media;
2. Identify appropriate media and resources to use for a specific learning situation; and
3. Develop appropriate resources/teaching aids.

Course Content

Communication model and learning; barriers to communication; overcoming barriers; visual communication in learning; verbal and non-verbal aspects of communication; the range of media for learning; varieties of community learning resources; electronic media in teaching and learning; using educational radio broadcasts in teaching; selection and use of print materials;

management multi-media centres; developments in educational media and resources; use of educational media and resources

Learning and Teaching Methods

Lecture method, discussions, and demonstrations

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Aggarwal, J. C. (). Principles, methods & techniques of teaching. New Delhi: Vikas Publishing PVT Ltd.

Aggarwal, J. C. (1995). Essentials of Educational Technology: Teaching Learning Innovations in Education. New Delhi: Vikas Publishing House PVT Ltd.

Farrant, J. S. (2002). Principles and Practice of Education. (New Ed). London: Longman.

RESEARCH METHODS IN EDUCATION Credit Hours 3

Course Purpose

To introduce students to the methods used in educational research.

Expected Learning Outcomes

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

1. Describe the meaning and purpose of research;
2. Describe the characteristics of research; and
3. Analyze research methods in pure and social sciences.

Course Content

Meaning and purpose of research; basic and applied research; characteristics of research; ethics in research; qualitative and quantitative research; research methods in pure and social sciences; problem identification and formulation of hypothesis; identification of variables, validity in research; literature review; preparing a research proposal; sampling methods and tools for collecting data; data organization and preparation; statistical tools for data analysis; interpretation and hypothesis testing; writing a research report; foot notes, references and bibliography; dissemination of research findings; a research project

Learning and Teaching Methods

Lectures, directed reading, practical demonstrations and group work.

Instructional Materials and/or Equipment

Textbooks, chalkboard, handouts, computer-based tools, LCD and overhead projectors

Course Assessment

Type	Weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Course Texts

Manion, L. and Morrison, K. (2011). Research Methods in Education.

EDUCATIONAL MEASUREMENT AND EVALUATION 3 Credit Hours

Course Purpose

To equip the learners with principles and practices for classroom assessment and evaluation

Expected Learning Outcomes

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

1. Explain the basic statistical methods of evaluation and measurement;
2. Apply the theories of evaluation and measurement in the classroom situation; and

3. Construct and use different instruments of evaluation.

Course Content

Measures of central tendency; measures of variability; correlation; testing and regression analysis; testing and hypothesis; philosophy and nature of educational testing with emphasis on reliability and validity; discrimination index; construction of objective and essay tests

Learning and Teaching Methods

Lecture, Discussion, Exercises.

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Keeves, J. (1994). Item Response Theory, Pergamum Press.

Kellaghan, T. & Greany ,V. (1992). Using Examinations to improve education, Washington DC.

EDUCATIONAL POLICY AND MANAGEMENT 3 Credit Hours

Course Purpose

To prepare teachers for management and leadership in education sector

Expected Learning Outcomes

At the end of this course, students should be able:

1. Describe the characteristics of a school organization;
2. Explain financial issues in educational institutions and implications for management in education; and
3. Discuss the changing role of teachers in educational management.

Course Content

Policy formulation and implementation; policies in education: legal framework of the education system & the Education Act; structure & organization of the Ministry of Education; support bodies; education administration theories; administrative processes; theories of motivation; leadership; financial management; Channels of communication; professional control and influence; school as an organization; teachers and the teaching profession; future prospects of education; role of teachers in schools and community; management styles

Learning and teaching Methods

Lecturer methods, Tutorials, Role play.

Course Assessment

Type	Weighing
Examination	70%
Continuous Assessment Tests	30%
Total	100 %

Course Texts

Mbiti, D. M. (1987). Foundations of School Administration. Nairobi: Oxford University Press.

Mutua, R. W. (nd). Development of Education in Kenya. Nairobi: KLB.

Eshiwani, G. S. (). Education in Kenya since Independence. Nairobi: EAEP.

Eshiwani, G. S. (1990). Implementing Educational Policies in Kenya.

World Bank Discussion Papers, Africa Technical Department. Washington D.C: The World Bank.

PLANNING AND ECONOMICS OF EDUCATION 3 Credit Hours

Course Purpose

To equip students with the knowledge of educational planning and economics of education

Expected Learning Outcomes

At the end of this course, the students should be able to:

1. Conceptualize the meaning and procedures in educational planning;
2. Explain economic issues related to education in Kenya; and
3. Explain the micro and macro economics of education.

Course Content

Educational planning; Workforce planning; Staff motivation and appraisal; principles of economics of education; demand for and supply of education; economic issues in education; micro economics of education; macro economics of education; socio economic development in education; human resource investment; efficiency in education; equality and equity in education; financing of education.

Learning and teaching Methods

Lectures, problem solving and discussions

Course Assessment

Type	Weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Course texts

Psacharopoulos, G. (1985). Returns to Education. A Journal of Human Resource.

Ayot, H. O. & Briggs, (1992). Economics of Education. Nairobi: Education Research and Publications.

Torado, M. (1977). Economics of Developing World. London: Longman.

Woodhall, G. N. (1985). Education for Development: An Analysis of Investment Choices. Oxford: Oxford University Press.

ENVIRONMENTAL EDUCATION 3 Credit Hours

Course Purpose

To equip students with knowledge of effects of human activities on environment

Expected Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the role of African traditions in environmental conservation;
2. Discus the impact of human development on the environment;
3. Identify sustainable methods of conserving the environment;
4. Develop an awareness and sensitivity to the total environment and its allied problems;
5. Acquire social values and concern for the environment and motivation for actively participating in its protection and improvement; and
6. Develop a sense of responsibility and urgency regarding environmental problems and their solutions.

Course Content

Definitions of environment and education; environmental management and education; effects of society and culture on environment; the relationship between technological development and environment; the need for environmental assessment in human activities

Learning and Teaching Methods

Discussion, lecture, site visits, and research.

Course Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Korir Koech Michael (1991). Education beyond the year 2000, journal of East African Development V.21, pp. 40-52.

Muthoka, Magret et al (1998). Environmental Education. Nairobi: Longhorn publishers.

Otiende J.E et al(1997). An introduction to Environmental Education. Nairobi: University of Nairobi Press.

ENTREPRENEURSHIP IN EDUCATION 3 Credit Hours

Course Purpose

Develop a creative teacher capable of discovering, understanding, controlling and adapting entrepreneurial acumen in education

Expected learning outcomes

At the end of the course, students should be able to:

1. Teach entrepreneurship skills and knowledge in education;
2. Explain entrepreneurship development in education; and
3. Critique government and non-governmental organizations' policies on business in education.

Course content

Meaning, purpose and types of businesses; Basic economic law; demand and supply; Business opportunities; Starting up of a business; Institutions and services that support business enterprises; Micro and macro constraints to business growth and development; Government and Non-government organizations' policy on business in Kenya; attracting and retaining customers; education as a business enterprise

Learning and teaching Methods

Lectures, directed reading

Instructional Material and/or Equipment

Text books, chalkboard, handouts, computer based tools LCD and overhead projectors

Course Assessment

Type	weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Course texts

McCormick, D. and Pedersen, P. O. (1996). Small Enterprises: Flexibility and Networking in an African Context. Nairobi: Longhorn Kenya.

SPECIAL METHODS IN TEACHING SCIENCE

The teaching subjects in Science are:

1. Mathematics
2. Physics
3. Chemistry
4. Biology
5. Geography

TEACHING METHODS IN MATHEMATICS Credit Hours 3

Expected Learning Outcomes

By the end of the course, students should be able to:

1. Outline the goals and objectives of Mathematics Education;
2. Prepare and teach Mathematics;
3. Apply appropriate theories and strategies in teaching Mathematics; and
4. Prepare and evaluate learners in Mathematics

Course Content

Goals and objectives of teaching Mathematics; teaching and learning Mathematics; learning theories and teaching strategies; problem-solving; methods of teaching Mathematics; essentials of good teaching; Preparation for teaching: scheme of work and lesson plan; methods of evaluation in Mathematics; micro-teaching

Course Assessment

Type	weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Recommended Reading Materials

Mutunga, P. & Breakel, J. (1987). Mathematics Education. London: University of London.

Mondoh, H. O. (2005). Methods of Teaching Mathematics. Nakuru: Egerton University Press.

Patel. M. M. & Ayot, H. O. (1992). Instructional Methods. London: London Institute of Education.

Further Reading Materials

Thugu, J. Wandera, K. Gachie, L. Alumande, G. (2008). Mastering PTE Education. Oxford: Oxford University Press.

KIE (2002, 2008). Syllabuses for Secondary School. Nairobi: KIE.

KIE (2002). Textbooks for Secondary School Education. Nairobi: KIE.

TEACHING METHODS IN PHYSICS Credit Hours 3

Expected Learning Outcomes

By the end of the course, students should be able to:

5. Outline the goals and objectives of Physics Education;
6. Prepare and teach Physics;
7. Apply appropriate theories and strategies in teaching Physics; and
8. Prepare and evaluate learners in Physics

Course Content

Goals and objectives of teaching Physics; teaching and learning Physics; learning theories and teaching strategies; problem-solving; methods of teaching Physics; essentials of good teaching; Preparation for teaching: scheme of work and lesson plan; methods of evaluation in Physics; micro-teaching

Course Assessment

Type	weighting
Continuous Assessment Tests	30%
Examination	70%

Total	100%

TEACHING METHODS IN CHEMISTRY **3** CREDIT HOURS

Expected Learning Outcomes

By the end of the course, students should be able to:

1. Explain the evolution and development of Chemistry as a school subject;
2. Identify and use various methods to teach Chemistry
3. Teach and evaluate learners in chemistry at high school level.

Course Content

Nature and development of chemistry; its contributions to society; aims, goals and objectives of teaching chemistry; methods of teaching chemistry; chemistry lab as a resource for teaching; other teaching resources; Chemistry secondary school curriculum; preparation for teaching chemistry: schemes of work and lesson plan; assessment and evaluation in chemistry; micro-teaching.

Course Assessment

Type	weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

Recommended Reading Materials

K.I.E. Chemistry Syllabus (8:4:4)

Twoli, N. (). Chemistry Methods Textbook

Waddington, I. D. (). Teaching School Chemistry

TEACHING METHODS IN BIOLOGY 3 Credit Hours

Purpose of the Course

Expected Learning Outcomes

By the end of the course, students should be able to:

4. Outline the goals and objectives of Mathematics Education;
5. Prepare and teach Mathematics;
6. Apply appropriate theories and strategies in teaching Mathematics; and
7. Prepare and evaluate learners in Mathematics

Course Content

Goals and objectives of teaching Mathematics; teaching and learning Mathematics; learning theories and teaching strategies; problem-solving; methods of teaching Mathematics; essentials of good teaching; Preparation for teaching: scheme of work and lesson plan; methods of evaluation in Mathematics; micro-teaching

Course Assessment

Type	weighting
Continuous Assessment Tests	30%
Examination	70%
Total	100%

SUBJECT METHODS IN GEOGRAPHY **3 CREDIT HOURS**

Purpose of the course of the Course

To equip the learner with knowledge, skills, values, attitudes and competences necessary for effective teaching in Geography.

Expected Learning Outcome

At the end of the course, the learner should be able to:

1. Apply varied teaching strategies in their teaching of geography
2. Demonstrate knowledge and skills in planning for teaching.
3. Demonstrate possession of knowledge of the geography curriculum syllabus.
4. Apply knowledge and skills in the presentation of content in the teaching process.
5. Explain and apply theories of motivation to class room instruction.
6. Demonstrate good classroom management.

7. Demonstrate knowledge and skills in setting, analyzing, administration, scoring of tests
8. Demonstrate knowledge and skills in measuring and analyzing student's scores or performance.
9. Demonstrate knowledge and skills in class record keeping

Course Content

Principals of teaching applied to Geography; specific teaching strategies in Geography; stating specific lesson objectives, activities and lesson delivery; exposure to and critique of the Kenya Certificate of Secondary School (KCSE) syllabus; preparation for teaching (scheme of work, teaching notes, lesson plan, record of work, student progress record); classroom management; learner stimulation (extrinsic and intrinsic motivation); identification, selection, development and use of teaching- learning resources-human and material resources; technology (e-learning, on-line learning and electronic media use); teaching skills practice through micro-teaching; preparation ad acquisition of teaching resources, utilization and preservation; interpersonal relationships with students and teachers; requisites of an effective Music teacher; Purpose of the course of measurements and evaluation in music (types of tests and examinations).

Teaching Methodologies

Lecture, tutorials, Internet, group discussions, projects, use of resource personnel, library and internet research, field trips (to different regions, museums and archives).

Instructional Materials/Equipment

Power point, whiteboards, hand-outs, transparencies, charts/maps. DVDs, slides

Course Assessment

Type	**Weighting**
Continuous assessment	30%
Final Examination	70%

TEACHING PRATICE (6 Credit units)

This is a practical course for students of education. It provides opportunity to apply and practice teaching principles in a real classroom and school environment. Each student is attached for a period of three months either to a secondary school, a relevant institute of technology or a normal polytechnic where they work under the guidance of the co-operating teacher and the university supervisor. During this exercise, each student is inducted into the teaching profession, guided and graded in two teaching subjects (e.g. Biology/Chemistry, Mathematics/Physics, Mathematics/Chemistry etc.)

Course assessment

Teaching practice supervision: 100%*

5.2 BIOLOGY COURSES

LEVEL ONE

INVERTEBRATE ZOOLOGY

Credit hours: 3

Pre-requisite: None

Purpose of the Course

To introduce the students to classification, structure, evolution, origin and economic importance of the animal phyla: Protozoa, Porifera, Cnidaria, Platyhelminthes, Ascelminthes, annelids, arthropods, molluscs and echinoderms.

Expected Learning Outcomes

At the end of the course, the students should be able to:

Use the principles of classification and taxonomy to assign animals to their respective groups or phyla.

Describe the occurence and possible evolutionary relationships between various acoelomate and coelomate animals.

Outline the economic and ecological importance of lower invertebrate animals.

Disect some invertebrate animal specimens for the study of internal organs.

Course Content

Introduction of the acoelomate, pseudo-coelomate and coelomate invertebrate animals: Protozoa, Porifera, Cnidaria, Platyhelminthes, Ascelminthes, annelids, arthropods, molluscs and echinoderms. The classification, Biology, adaptive radiation, phylogeny and functional significance of the structural components of these phyla.

The nature of the animal cell and origin of multi-cellular organisms. Evolutionary relationships among phyla. Structure and organization of the invertebrate body (Segmentation, cephalization and origin of the coelom). Symmetry and its importance. Economic importance of invertebrates.

Mode of delivery

Lectures, tutorials, directed reading, assignments & laboratory practicals including sdissection.

Instructional Materials and/or Equipment

Chalk boards, Texts, charts, video cassettes, live specimens, preserved specimens and dissecting kits.

Mode of Assessment	Type	Weighting (%)
	Continuous assessment tests	30
	Final examination	70
	Total	100

Recommended References

Brusca, R.C., Brusca, G.J. and Haver, N. J. (2003). Invertebrates. Second edition. Sunderland: Sinauer Associates, Inc. Publishers. ISBN-13: 978-0878930975.

Jordan, L.E. and Verma, P.S. (2006). Invertebrate Zoology. S. Chand & company LTD. ISBN: 81-219-0367-X.

Pechenik, J. (2009). Biology of the Invertebrates. Sixth edition. McGraw-Hill Science. ISBN-13: 978-0073028.

Ruppert, E. E. and Barnes, R.D (1994). Invertebrate Zoology. Sixth edition. Brooks/ Cole Publishing Company. ISBN-13: 978-0030266683.

Ruppert, E. E., Fox, R. S. and Barnes, R. D. (2003). Invertebrate Zoology: A Functional Evolutionary Approach. Seventh edition. Brooks Cole. ISBN-13: 978-0030259821.

Sleigh, M.A (1989). Protozoa and other protists. First edition. Cambridge University press, Cambridge. ISBN: 0-521 417751-1.

VERTEBRATE ZOOLOGY

Credit hours: 3

Pre-requisite: None

Purpose of the Course

To study the origin, classification, structure, distribution, evolutionary relationships and economic importance of vertebrate animals.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Classify the vertebrate animals into their phyla, classes, orders, families, genera and species.
2. Describe the structure, diversity, distribution of vertebrates.
3. Describe the phylogenetic relationships between chordates and within vertebrate phyla.
4. Explain the structural and physiological adaptations of various vertebrates to their environment.
5. Describe the ecological and economic importance of vertebrates.

Course Content

Introduction to the chordates and origin of vartebrates. Structure and function of the notochord, organization of the head, evolution and adaptive radiation of vertebrates. The classification, structure, function and development of vertebrates without jaws (Agnatha) and vertebrates with

jaws (Gnathostomata): modern fishes, amphibians, reptiles, birds and mammals. Ecology, adaptive radiation, phylogeny and economic importance of vertebrates.

Mode of delivery

Lectures, tutorials, directed reading, assignments & laboratory practicals.

Instructional Material and/or Equipment

Chalk boards, Texts, charts, video cassettes, preserved specimens and dissecting kits.

Mode of Assessment	Type	Weighting (%)
	Continuous assessment tests	30
	Final examination	70
	Total	100

Recommended References

Alexander, R.M (1975). The chordates. Cambridge University Press, Cambridge. ISBN: 0-521-20472-0.

Hairston, N.G. (1994). Vertebrate Zoology. An experimental field approach. Cambridge University Press, Cambridge ISBN 0-521-41703-1

Young, J. Z. (1981). The life of Vertebrates. Oxford University Press, Oxford. ISBN: 0-19-442393-X.

LEVEL TWO

DEVELOPMENTAL BIOLOGY

Credit hours: 3

Pre-requisite: None

Purpose of the Course

To study the development of gametes, embryo and larval development in animals.

Expected Learning Outcomes

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

1. Explain the importance and significance of reproduction in animals.

2. Describe the processes of gametogenesis and vitellogenesis.
3. Describe early and later embryonic development in amphioxus, frog, pig and man.
4. Describe the processes of blastulation, gastrulation, neurulation and organogenesis
5. Identify the different embryonic membranes and their functions.
6. Describe changes in development of the chick and man embryo.

Course Content

Development of invertebrates and vertebrates. Gametogenesis, cleavage, egg polarity, vitellogenesis and types of eggs. Early embryonic development, fertilization, cleavage and blastulation in animals such as Amphioxus, frog, chick and mammals. Later embryonic development, fate maps, morphogenetic movements, gastrulation, neurulation and organogenesis. Formation of germ layers. Extra-embryonic membranes, larval development and metamorphosis. Viviparity in mammals and its origin. Regeneration, transplants, grafting and congenital malformations.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, prepared slides and Video cassettes.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Gilbert, S. F. (2000). Developmental Biology. Sixth edition. Sinauer Associates. ISBN-10: 0-87893-243-7.

Kalthoff, K.O. (2001). Analysis of Biological Development. Second edition. McGraw-Hill Publishing Company. ISBN-13: 9780070920378.

Schoenwolf, G.C. (2008). Atlas of Descriptive Embryology. Seventh edition. Prentice Hall, Inc. ISBN-13: 9780131585607.

Slack, J.M.W. (2005). Essential Developmental Biology. Second edition. Wiley-Blackwell. ISBN-13: 978-1-4051-2216-0.

GENERAL ECOLOGY

Credit hours: 3

Pre-requisite: None

Purpose of the Course

To introduce students to ecological concepts in ecosystems, communities and populations.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Define and explain the commonly used ecological terms.
2. Explain the interrelationships between biotic and abiotic factors.
3. Describe factors that regulate population growth and dynamics.
4. Explain the ecological differences between terrestrial, aquatic, Wetland and ecotone ecosystems.
5. Describe energy flow, biochemical and nutrient cycles in ecosystems.
6. Describe human impacts on ecosystems and explain how natural resources in an ecosystem may be conserved.

Course Content

Definition of ecology, meaning and its importance. Structure of ecosystems, interrelationships between biotic and abiotic factors. Ecosystem, habitat competition and niche concepts. Studies of terrestrial, aquatic, wetland ecosystems and ecotones. Energy flow, mineral or nutrient and biogeochemical cycles. Structure and dynamics of communities and populations. Ecology of populations including definition, sampling, dynamics and regulation of population. Palaececology. Human use and impact on ecosystems. Resiliency and resistance of ecosystems.

Mode of delivery

Lectures, tutorials, directed reading, assignments, laboratory practicals and field trips.

Instructional Material and/or Equipment

Texts, Manuals, charts, Plankton nets, Sample bottles, Grab samplers, Microscopes, Meters., boats.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Cain, M. L., Bowman, W. D. and Hacker, S. D. (2008). Ecology. First edition. Sinauer Associates, Inc. ISBN-13: 978-0878930838.

Krohne, D. T. (2000). General Ecology. Second edition. Brooks Cole Publishing. ISBN-13: 978-0534375287.

Newman, E. I. (2000). Applied Ecology and Environmental Management. Second edition. Blackwell Science Inc. ISBN-13: 978-063204654.

Townsend , C. R., Begon. and Harper, J.L. (2008). Essentials of Ecology. Third edition. Wiley-Blackwell. ISBN-13: 978-1-4051-5658-5.

LEVEL THREE

CELL BIOLOGY

Credit hours: 3

Pre-requisite: None

Purpose of the Course

To introduce students to the cell as a basic unit of life in order to understand the structure, functions and cycles of prokaryotic and eukaryotic cells.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Apply the use of microcopy in the study of cells.
2. Draw the structure of a typical cell showing the organelles
3. Explain the role of cells in growth, reproduction and inheritance.
4. Describe the functions of prokaryotic and eukaryotic cells and their organelles.

5. Explain the processes and main differences between mitosis and meiosis.
6. Describe the plasma membranes and explain how materials move across them.

Course Content

The light microscope and its contribution to the study of the cell. History of the cell and cell theory. The structure and ultrastructure of cells. Prokaryotic and eukaryotic cells. Levels of organization: typical cell, specialized cell tissues. The cell cycle: mitosis, meiosis. Cell separation and fractionation. Transport across membranes: osmosis, diffusion, active transport, Germ cells, embryogenesis and differentiation. Cellular locomotion: amoeboid, ciliary. Structure of microtubules and microfilaments and their use in cell motility and division as well as in movement of secretory vesicles and in flagella and cilia beating.

Mode of delivery

Lectures, tutorials, directed reading, assignments and laboratory practicals.

Instructional Material and/or Equipment

Chalk boards, Texts, Manuals, charts, Microscopes.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2010). Essential Cell Biology. Third edition. Garland Science. ISBN-13: 0815344599.

Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2002). Molecular Biology of the Cell. Fourth edition. Garland Science. ISBN-13: 978-0815332183.

De Roberts, E.D.P. and De Roberts, E.M.F. (2001). Cell and Molecular Biology. Eighth edition. B.I. Publications, pvt Ltd. ISBN: 0-7817-3493-2.

Smith, C. A. And Wood, E.J. (1994). Cell Biology. Chapman & Hall. ISBN: 0-412-40740-X.

Tres, L. and Kierszenbaum, A. L. (2011). Histology and Cell Biology: An Introduction to Pathology. Kindle edition. A Mosby Title. ASN: B005413 NJK.

ANIMAL PHYSIOLOGY

Credit hours: 3

Pre-requisite: Vertebrate Zoology

Purpose of the Course

To study the structure and function of animal body systems and to compare the basic principles and mechanisms involved in the control of physiological functioning of organ systems in selected inverterbrate and verterbrate animals.

Expected Learning Outcomes

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

1. Describe the body fluids, homeostasis and control systems of animals.
2. Explain the internal and external factors that control body functions.
3. Describe the structure and function of the animal body organ systems: Integumentary, skeletal, muscular, circulatory, nervous. Endocrine, respiration, digestive, urinary and reproductive.
4. Describe the biological body systems that support the integrity of the animal body.

Course Content

Levels of structural organization, Body fluids, homeostasis and control systems. Structure and function of the animal body systems: integmentary, skeletal, muscular, circulatory, nervous, endocrine, respiration, digestive, urinary and reproductive. Senescence.

Physiological mechanisms of digestion, reproduction, respiration, circulation, osmoregulation, thermoregulation and neurophysiology in selected invertebrates and vertebrates. Relation of physiological mechanisms to ecology and phylogeny. Senses: smell, vision and hearing. Metabolism and hormonal integration.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, prepared slides,Microscopes, respirometers and Video cassettes.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Hill, R.N. (2008). Animal physiology. Second edition. Sinauer Associates, Inc. ISBN: 0878933174.

Schmidt-Nielsen, K. (1997). Animal Physiology: Adaptation and Environment. Cambridge University Press. ISBN-13: 9780521570985.

Withers, P.C. (2001). Comparative Animal Physiology. Saunders. ISBN-13: 9780127604510.

LEVEL FOUR

PARASITOLOGY AND IMMUNOLOGY

Credit units: 3

Pre-requisite: None

Purpose of the Course

To introduce students to biological associations, types of parasites and hosts and to study the evolution of parasitism, distribution of parasites, host-parasite relationships, immunity and disease of parasitic groups.

Expected Learning Outcomes

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

1. Describe morphology and use diagnostic features to identify the protozoan, helminthic and arthropod parasites.
2. Describe the life cycle and methods of transmission of parasitic protozoa.
3. Describe the major arthropod vectors of parasitic protozoan.
4. Describe the local and global distribution of parasites
5. Explain the life cycles, epidemiology, diagnosis, treatment and control of various parasite infections.

6. Define allergy/hypersensitivity and differentiate the various types of hypersensitivity reactions.
7. Discuss the economic importance of the various parasitic groups.

Course Content

Introduction to parasitism and related phenomena. Adaptation to parasitic modes of life and host-parasitic relationships. The classification, morphology and life cycles of protozoan, helminth and arthropod parasites of medical and veterinary importance. Physiology and biochemistry of parasites. Methods of transmission and major arthropod vectors and intermediate hosts of parasites. Epidemiology, diagnosis, treatment and control of parasitic infections. Immunology of infections. Allergy/Hypersensitivity. Types of hypersensitivity reactions. Autoimmunity and origins of autoimmune diseases. Non-parasitic disease causing organisms such as bacteria, fungi and viruses.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations, microscopes and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, prepared slides and preserved specimens.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Chiodini, P.L., Moody, A.H. and Manzer, D.W. (2006). Atlas of Medical Helminthology and Protozoology. Fourth edition. Churchill Livingstone.

Farmer, J.N. (1980). Protozoa. Introduction to Protozoology. Elsevier Science, Health Science Div. ISBN-13: 9780801615504.

Matthews, B.E. (1998). An Introduction to Parasitology. Cambridge University Press. ISBN 0-521-57170-7.

Noble, E.R. and Noble, G.A. (1982). Parasitology. The Biology of Animal Parasites. Fifth edition. Lea and Febiger. ISBN 0-8121-0819-1.

Symth, J.D. (1994). Introduction to Animal Parasitology. Third edition. Hodder and Stoughton. ISBN 0-521-42811-4.

EVOLUTIONARY BIOLOGY

Credit units: 3

Pre-requisite: Invertebrate Zoology, Vertebrate Zoology

Purpose of the Course

To study the probable origin of life, the underlying mechanisms governing genetics, anatomy and behaviour among different groups of organisms and evidence of evolution.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Describe characteristics of a population, its abundance and how populations are estimated.
2. Describe the probable origins of life.
3. Explain the similarities in the underlying mechanisms governing genetics, anatomy and behaviour among different groups of organisms.
4. Explain the importance of evolutionary theory to other disciplines in the biological and social sciences.

Course Content

Geological time scale andorigin of life. Pre-Darwinian (early) and Darwinian theories of evolution. Evidence for evolution and mechanisms of evolution, natural selection and sexual selection. Neo-Darwinian theory of evolution and diversity and variability in evolving populations. Other mechanisms of evolution (mutation, genetic drift, founder principle among others). The species concept, modes of speciation and co-evolution. Adaptive radiation and evolution of supra-specific categories. Biological classification of organisms and phylogeny. Evolution of social behaviour and implications of evolutionary theories.

Mode of delivery

Lectures, tutorials, directed reading and assignments.

Instructional Material and/or Equipment

Texts, Manuals, charts, and Video cassettes.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Futuyma, D. J. and Futuyma (1997). Evolutionary Biology. Third subedition. Sinauer Associates. ISBN-13: 978-0878931897.

Lane, N. (2010). Life Ascending: The Ten Great Inventions of Evolution. First edition. W. W. Norton & Company. ISBN-13: 978-0393338669.

Niklas, K. J. (1997). The evolutionary biology of plants. The University of Chicago Press, Ltd. ISBN: 0-226-58083-0.

Sober, E. (ed) (1994). Conceptual Issues in evolutionary biology. Second edition. Massachusetts Institute of Technology. ISBN: 0-262-69162-0.

5.3 BOTANY COURSES

LEVEL ONE

GENERAL BOTANY

Credit units: 3

Pre-requisite: None

Purpose of the Course

To study the general structure, characteristics and biology of representatives of the four kingdoms. Monera, Protista, Fungi and Plantae.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Differentiate prokaryotes and eukaryotes.
2. Describe the characteristics of representative groups.
3. Describe the anatomy and morphology of the vegetative and reproductive organs of angiosperms.
4. Describe the basic characteristics of the life of plants: photosynthesis, respiration, movement of materials in plants.
5. Explain the economic importance of all members of the four kingdoms.

Course Content

General characteristics, classification, occurrence and economic importance of bacteria, protists, fungi, lichens, pryophytes, pteridophytes, gymnosperms and angiosperms. Anatomy and morphology of gymnosperms and angiosperms. The structure of the flower and inflorescence. Evolution of reproductive structures, and stems of members of the four kingdoms. Introductory study of the life processes of plants such as photosynthesis, respiration, movement of materials, growth and differentiation.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, Video cassettes and prepared slides.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Curtis, C.C. (2009). A TextBook of General Botany. General Books LLC. ISBN-13: 9781151167774.

Dutta, A.C (1997). Botany for degree students. Revised edition. Oxford University Press India. ISBN-13: 9780195637489.

Evert, Ray Franklin and Esau, Katherine (2006). Esau's Plant anatomy: meristems, cells, and tissues of the plant body - their structure, function and development. Hoboken, John Wiley, New Jersey. ISBN 0-471-73843-3.

Raven, P. H.; Evert, R. F. and Eichhorn, S. E. (2005). Biology of Plants. Seventh edition. New York: W. H. Freeman. ISBN 0-7167-1007-2.

Smith, G.M. and Overton, J.B. (1999). A Text-Book of General Botany. Indus International. ISBN: 8126102195.

GENERAL GENETICS

Credit units: 3

Pre-requisite: None

Purpose of the Course

To introduce students to basic principles of classical genetics and inheritance as demonstrated in Mendelian laws. Cell function and phenotypic expressions in organisms.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Apply Mendelian laws of inheritance.
2. Explain factors that may cause deviations from patterns of mendelian inheritance.
3. Explain factors responsible for sex determination in plants and animals.
4. Describe the causes and symptoms of sex abnormalities in man.
5. Describe types, causes and consequences of mutations.

Course Content

Non-mendelian inheritance: multiple alleles, gene interactions, cytoplasmic interactions, linkages and mapping. Population genetics: sources and maintenance of variation. Role of variation in crop and livestock improvement. Hardy-weinberg equation and its implications. Introduction of DNA and RNA. The genetic code. Genes, proteins and phenotype. Mendelian genetics. Sex linkage and determination and mutations.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, Video cassettes, plants.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Acquaah, G. (2006). Principles of Plant Genetics and Breeding. Wiley-Blackwell. ISBN: 978-1-4051-3646-4.

Dale, J.W. and Park, S.F. (2010). Molecular Genetics of Bacteria. Fifth edition. Wiley-Blackwell. ISBN: 978-0-470-74185-6.

Jones, S. (1993). The language of the Genes. Harper-Collins. ISBN: 0006552439.

Snustad, DP. And Simmons, M.J. (2009). Principles of Genetics. Fifth edition. International Student version. Wiley-Blackwell. ISBN: 978-0-470-39842-5.

Smith, M. (2009). The year in Human and Medical Genetics. Wiley-Blackwell. ISBN: 978-1-57331-731-3.

LEVEL TWO

SYSTEMATICS AND TAXONOMY OF PLANTS

Credit units: 3

Pre-requisite: General Botany

Purpose of the Course

To study the identification techniques and nomenclature of lower (algae, ferns and gymnosperms) and higher (monocot and dicot angiosperms) plants in order to understand the diversity, phylogeny, biosystematics and evolution of plants.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Identify common algal, fern, gymnosperm and angiosperm families of East Africa.
2. Apply plant collection and preservation techniques to develop a herbarium.
3. Describe the basic principles of taxonomy, identification and classification of plants.
4. Describe the phylogenetic relationships between plants.
5. Outline the ecological and economic importance of algae, ferns, gymnosperms and angiosperms in medicine, food industry, biotechnology and fish industry.
6. Name plants (scientifically) according International Taxonomic Nomenclature.

Course Content

History and significance of plant taxonomy. Development of taxonomic units. Artificial and natural classification. Taxonomic characters. Nomenclature. Sources of phytogenetic evidence. Biosystematics and modern taxonomy. Taxonomic resources. Use of keys and Identification techniques. Survey of selected angiosperm families of East African flora. Economic importance of selected families.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, Video cassettes, Herbarium and fresh plant specimens.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Dutta, A.C (1997) Botany for degree students. Revised edition. Oxford University Press India. ISBN-13: 9780195637489.

Leadlay, E. and Jury, S. (2006) Taxonomy and Plant Conservation. Cambridge University Press. ISBN-13: 978-0-521-60720-9.

Sharma, O.P. (1993) Plant Taxonomy. Tata McGraw-Hill Publishing CO. LTD. ISBN-13: 978-0-07-460373-4.

Spencer, R., Cross, R. and Lumbley, P. (2007) Plant names: A guide to botanical nomenclature. Third edition. Csiro Publishing, Oxford. ISBN-13: 978-0-85199-807-7.

GENERAL MICROBIOLOGY

Credit units: 3

Pre-requisite: General Botany

Purpose of the Course

To study the morphology, classification, physiology and economic importance of micro organisms in life.

Expected Learning Outcomes

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

1. Apply the techniques of culturing and staining of microorganisms in the laboratory.
2. Describe the cellular structures of prokaryotic and eukaryotic microorganisms.
3. Explain the physiological role of microbes in various industrial and agricultural chemical processes.
4. Describe some microbial diseases, their transmission and control.
5. Explain the ecological and economic importance of microorganisms in the environment.

Course Content

Historical development of microbiology. Classification and characteristics of bacteria, viruses, fungi, algae, protozoa, prion, mycoplasmas, Chlamydia and rickettsia. Economic importance of microorganisms: microorganism physiology and micro-organisms as pathogens to man, plants and animals. Public health and emerging microbial diseases. Isolation and identification of bacteria, fungi and viruses. Growth and cuturing of microorganisms. Culture improvements. Biotech products. The immune system, microorganism control methods and strategies.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, Video cassettes, prepared slides and fresh slides.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Cowan, M.K and Talaro, K.P (2009). Microbiology: A systems Approach. McGraw-Hill Publishing Company. ISBN-13: 9780072995282.

Schelegel, H.G. (1993). General microbiology. Seventh edition. Cambridge University Press. ISBN-13: 9780521439800.

Stanier, R.Y. (1987). General Microbiology. Palgrave MacMillan. ISBN-13: 9780333417683.

Tortora, G.J., Funke, B.R. and Case, C.L. (2010). Microbiology: An Introduction. Tenth edition. Benjamin-Cummings Publishing Company. ISBN-13: 9780321582027.

LEVEL THREE

PLANT PHYSIOLOGYAND BIOCHEMISTRY

Credit units: 3

Pre-requisite: General Botany

Purpose of the Course

To study the classification, structure and function of carbohydrates, lipids, proteins and enzymes and their movement through soil water-plant systems. To also study photosynthesis, its types, and photosynthetic apparatus, reactions involved and environmental factors controlling it.

Expected Learning Outcomes

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

1. Describe the structure, function and biosynthesis of carbohydrates, lipids, proteins and enzymes.
2. Define and describe the transformation of light energy into chemical energy.

3. Describe the role of hormones in plant growth and development and explain how they and other environmental factors limit photosynthesis.
4. Describe mechanisms of assimilation of carbon, and both organic and inorganic nitrogen in plants.
5. Discuss the catabolic process in plants.
6. Define photosynthesis and describe photosynthetic types and their apparatus.
7. Explain electron transport and photophosphorylation reactions in photosynthesis.
8. Differentiate C3 and C4 pathways of photosynthesis.

Course Content

Metabolism and biosynthesis of carbohydrates, lipids and proteins. Nitrogen cycle: assimilation of organic and inorganic nitrogen in plants. Nature and functions of enzymes, co-enzymes and vitamins. Plant organic acids. The C3 and C4 pathways of photosynthesis. Crassulacean acid metabolism (CAM). Photorespiration, Biosynthesis of phytohormones and their mode of action. Plant responses to environmental factors: photoperiodism, phytochrome system, vernalization, gravity and plant movements. Nature of damage to photosynthesis. Leaf and canopy photosynthesis.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, Video cassettes, titration equipment/oxygen meters, BOD bottles, Winklers reagents.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Hall, D. O. and Rao, K. K. (1994). Photosynthesis. Fifth edition. Cambridge University Press. ISBN: 0 521 43036-4.

Purohit, S.S. and Kumar, A. (2011). Plant Physiology: Fundamentals and Applications. Agribios. ISBN-13: 9788177540949.

Street, H.E. and Opik, H. (1984). The Physiology of Flowering plants, their growth and development. Third edition. Edward Arnold. ISBN: 0-7131-2883-6.

Salisbury, F.B and Ross, C.W (1978). Plant Physiology, Second edition. Wordswarth publishers Company , Inc. ISBN: 0-534-00562-4.

Schopfer, P. and Mohr, H. (1995). Plant Physiology. Springer-Verlag, Berlin. ISBN: 81-8128-401-1.

Taiz, L. (2006). Plant Physiology. Fourth edition. Sinauer Associates, Inc. ISBN-13: 9780878938568.

Wilkins, M.B. (1989). Advanced Plant Physiology. Longman ELBS. ISBN-13: 9780582055056.

BIOSTATISTICS

Credit units: 3

Pre-requisite: None

Purpose of the Course

To study methods of experimental design, data collection, analysis, interpretation and application in research in biology.

Expected Learning Outcomes

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

1. Apply biostatistics to solve problems in biological studies.
2. Demonstrate skills in experimental design, sampling, data collection, analysis and interpretation.
3. Analyze research data using parametric and non-parametric statistical tests.

Course Content

Introduction to quantitative treatment of biological data. Sampling, data collection and presentations using tables and diagrams. Descriptive and inferential statistics. Measures of central tendancy and dispersion. Probability. Binomial, poison and normal probability distributions, 2-scores. Hypothesis, significance test and level. Confidence intervals and limits. Data transformations. Parametric stastics: students t-test, F-tests. ANOVA I, ANOVA II. Non-parametric statistics: Chi Square tests, sign test, wilcoxon's rank test, krustal-wallis test. Correlation and regression analysis. Computer statistical programmes.

Mode of delivery

Lectures, tutorials, assignments, discussions, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Chalk boards, Texts, Manuals, charts, Computers

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Bluman, A.G. (2008). Elementary statistics: A step by step Approach Formula Card. Seventh edition. McGraw-Hill Higher Education. ISBN-13: 9780077302351.

Rosner, B. (2010). Fundamentals of Biostatistics. Duxbury Press. ISBN-13: 9780538733496.

Rastogi, V.B. (2009). Fundamentals of Biostatistics. ANE Books. ISBN-13: 9788180522550.

Le, C.T. (2003). Introductory Biostatistics. First edition. Wiley-Interscience. ISBN-13: 978-0471418160.

Vann, E. (1972). Fundamentals of Biostatistics. Heath Publishers. ISBN-13: 9780669617474.

LEVEL FOUR

PLANT PATHOLOGY

Credit units: 3

Pre-requisite: General Microbiology

Purpose of the Course

To study the causes, aetiology, epidemiology and control of parasitic and non-parasitic plant diseases.

Expected Learning Outcomes

At the end of the course, students should be able to:

1. Describe the life cycle of parasitic plant diseases.
2. Describe the physiology of pathogenesis and plant defence mechanisms.
3. Apply the principles of disease management in parasitic plant diseases in management of diseases of agricultural crops.
4. Describe disease epidemiology, forecasting and crop loss assessment in non-parasitic plant diseases.
5. Describe the role of genetics in host pathogen resistance.

Course Content

The concept of plant disease and significance of crop losses. History of plant pathology. Disease causal agents, fungi, bacteria, viruses, Mycoplasmas, nematodes, seed plants and adverse forecasting. Principles and practices of disease control, quarantines, cultural, biological, varietal resistance, physical and chemical methods. Diseases of important crops in Kenya. The symptoms, pathogens, transmission, disease cycle and control. Methods of assessing diseased crop losses. Techniques for diagnosing plant diseases.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, fresh and preserved specimens.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Agrios, G.N. (2005). Plant Pathology. Fifth edition. Academic Press. ISBN-13: 978-0120445653.

Harshberger, J.W. (2010). A Text-Book of Mycology and Plant Pathology. Third edition. NABU PR. ISBN-13: 978-1147179514.

Sambamurty, A.V.S.S. (2006). A Text-Book of Plant Pathology. I.K. International PVT. LTD. ISBN-13: 9788188237609.

Schumann, G.L. and D'Arcy, C.J. (2009). Essential Plant Pathology. Second edition. APS Press. ISBN-13: 978-0-89054-381-8.

Trigiano, R.N., Windham, M.T. and Windham, A.S. (2007). Plant Pathology: Concepts and Laboratory Exercises. Second edition. CRC Press. ISBN-13: 978-1420046694.

MOLECULAR AND MICROBIAL GENETICS

Credit units: 3

Pre-requisites: General Genetics, General Microbiology

Purpose of the Course

To study the nature of genetic material and genes expression in prokaryotes including regulation, mutation, gene transfer and recombination.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Describe the nature, structure and function of genetic materials in micro organisms.
2. Describe DNA synthesis, transcription and protein synthesis.
3. Explain the molecular basis of mutations.
4. Describe genetic recombination, transformation, conjugation and transduction in bacteria.
5. Demonstrate the use and importance of micro organisms as biotechnological tools in plant and animal health.
6. Apply the knowledge of genetic engineering to solve problems in agriculture, medicine and industry.

Course Content

Nature, structure and functions of the genetic material in microorganisms. DNA synthesis, transcription and protein synthesis. The genetic code. Molecular basis of mutation. Genetic recombination, transformation, conjugation and transduction in bacteria. Plasmids, recombinant DNA technology. Gene regulation and supression in microorganisms. Genetic engineering of plants, viral vectors, haploids, protoplasts, hybrids and fusion. Mutagenesis, molecular and somatic hybridization. Genetic engineering, Fermentation, and down stream processing. Biosensors, formation and recovery of biologicals. Applications in agriculture, medicine, industry, health care and food processing with reference to Kenyan situations.

Mode of delivery

Lectures, tutorials, directed reading, assignments, demonstrations and laboratory practicals.

Instructional Material and/or Equipment

Texts, Manuals, charts, Microscopes, models, bacterial cultures.

Mode of Assessment

Type	Weighting (%)
Continuous assessment tests	30
Final examination	70
Total	100

Recommended References

Howe, C. (2007). Gene cloning and Manipulation. Second edition. Cambridge University Press. ISBN-13: 978-0521521055.

Nair, A. J. (2008). Introduction to Biotechnology and Genetic Engineering. Jones & Bartlett Publishers. ISBN-13: 978-1934015162.

Nicholl, D. S. T. (2008). An Introduction to Genetic Engineering. Third edition. Cambridge University Press. ISBN-13: 978-0521615211.

Scandalios, J.G. (1984). Advances in Genetics Molecular Genetics in Plants. Academic Press. ISBN: 012017622X.

Schleif, R. (1993). Genetics and Molecular Biology. Second edition. The Johns Hopkins University Press. ISBN: 0801846749.

Schmitt, M. and Schaffrath, R. (2005). Microbial Protein Toxins (Topics in Current Genetics). First edition. Springer. ISBN: 3540235620.

5.4 CHEMISTRY COURSES

LEVEL ONE

FUNDAMENTALS OF CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the basic theories and concepts of atomic structure and discussion leading to the development of chemical bonding.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Explain the structure of the atom from the fundamental principles.
2. Use kinetic theory to explain the behaviour of gases and derive gas laws.
3. Apply the Hess's law in determining heat of reactions
4. Apply the Le Chatelier's principle to explain equilibrium reactions.

Course Content

Atomic Structure: Effect of electricity on gases, cathode rays, discovery of electrons, nucleus (α-particles), isotopes, mass numbers, relative atomic masses. Atomic Models: Thomson's, nuclear, Rutherford's, Bohr's and Quantum mechanical models.

Electronic structure and configuration: Energy levels and quantum numbers, orbitals and orbits. Spin, Hund's rule, Pauli exclusion principle and Aufbau's building up principle. Periodic Table: Periodic law, groups, periods and Chemical bonding and Structure: Types of bonds; Bonding theories; valence and molecular orbital theories; Intermolecular forces: Van der Waals' forces and hydrogen bonding. Structures and shapes of simple molecules. Stoichiometry: The mole concept. Volumetric analysis: balancing of equations. Redox reactions; Electron transfer reactions. Gases, liquids and solids: Properties and comparison, structures of solids, Kinetic theory of matter. Gay Lusaac's and Avogadro's theories, Gas Laws and ideal gas equation. Energetics: Heats of reactions. Hess's law and Born-Haber cycle. Lattice energy. Equilibria: Equilibrium constant, Le Chateliar' s principle, solubility product. Reaction Rates: Factors affecting reaction rates, order of reactions and rate laws.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting (%)
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Brown, D.L., LeMay, H.E. and Bursten, B.E. (2006). Chemistry: The central science, Prentice Hall International, 10th Edition.

Chang, R. (2002). Chemistry. 7th Ed. McGraw-Hill.

Kapoor, R., Vasisht, S.K and Chopra, R.S. (2000). Inorganic Chemistry. R. Chand & Co. Publishers.

Martin S. Silberberg. (2009). The Molecular Nature of Matter and Change. 5th Ed. McGraw Hill.

INTRODUCTION TO ORGANIC CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to chemical bonding and properties of organic chemistry.

Expected Learning outcomes

At the end of the course, the students should be able to:

1. Explain why carbon is an important element in organic chemistry.
2. Apply the rules used in naming, classifying and drawing organic structures.
3. Relate the structures of compounds to the chemical and physical properties.

Course Content

Introduction to Carbon Chemistry: Its Uniqueness and importance of Organic Chemistry. Classification of organic compounds, functional groups and homologous series and formulae.

Alkanes, alkenes, alkynes, aromatic hydrocarbons (arenes**),** organic halogen compounds, alcohols, phenol and ethers, aldehydes and ketones, carboxylic acids, esters and amines: Definition, structures, nomenclature, preparation, physical and chemical properties and uses.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting (%)
Examination	70%

Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Graig, F.T.W., Solomns, G. (2000). Organic Chemistry. John Wiley & Sons.

Clayden, J., Greeves, N., Warren, S., Wthers, P. (2007). Organic Chemistry. Oxford.

Morrison, R.T., Boyd, R.N.(1987). Organic Chemistry. 5th Ed. Allyn & Bacon. Inc.

INTRODUCTION TO ANALYTICAL CHEMISTRY

Credit hours: 3

Course Purpose
The purpose of this course is to introduce students to the principles in basic analytical chemistry.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Discuss the nature and scope of analytical chemistry.
2. Apply the principles and practice of precision in measurement.
3. Apply the skills of separation techniques in analytical chemistry.

Course Content

Introduction to elementary quantitative analysis. Principles and practice of precision measurement in chemistry. Sampling, analytical method selection and statistical treatment of data. Types of errors; precision and accuracy. Distribution of errors: mean, standard deviation, variance, student t-test and confidence limits. Gravimetric analysis; precipitation; titrimetric analysis; acid-base and oxidation-reduction and complexometric analysis. Separation techniques: such as liquid-liquid extraction, fractional distillation, crystallization, and chromatography including TLC, paper, column, ion-exchange, gas- liquid and high pressure liquid methods.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Hadjiioannou, T.P, Christian, G.D., Etstathion, C.E and Nikolelis, D.P. (1998). Problems for analytical chemistry. Pergamon Press.

Miller, J.C. and Miller, J.R. (1988). Statistics for Analytical Chemistry, 3rd Edition. Ellis Horwood Ltd.

Underhood, A.L and Day, R.A. (2001). Quantitative analysis. Prentice Hall, 8th Edition.

Skoog, D.A., West, D.M., Holler, F.J., Crouch, S.R. (2004). Fundamentals of Analytical Chemistry. 8th Ed. Thomson.

ORGANIC CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the structure and reactivity of organic molecules, chirality and addition reactions.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Give reaction mechanisms of different types of reactions
2. Discuss optical activity and separation of R/S enantiomers
3. Differentiate between the stereochemistry of E1 and E2.

Course Content

Introduction to organic synthesis; General survey of the scope and limitations. Stereochemistry: Conformation in alkanes. Chirality. Molecules with one asymmetric carbon. enantiomerism. R/S system of nomenclature. Optical activity. Molecules with more than one asymmetric carbon. Diastereoisomerism. Meso compounds. Nomenclature. Separating enatiomers. Reaction mechanism: Nucleophilic substitution reactions: S_N2 reactions and S_N1 reactions. Elimination reactions: E2 reaction and E1 reaction (mechanism, rearrangement), E2 versus E1. Stereochemistry of E1 and E2 reactions, Elimination from cyclic compounds, Elimination versus substitution. Addition reactions: Addition of hydrogen halides, addition of water and alcohols, addition of halogens (stereospecificity), oxymercuration-reduction, hydroboration-oxidation, addition of radicals (anti-markovnikov), addition of hydrogen (syn and anti-additions).

Learning and Teaching Methods

Lecture, Discussion, Practicals, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Clayden, J., Greeves, N., Warren, S., Wthers, P. (2007). Organic Chemistry. Oxford.Fryhle G.T.W., Solomns, G. (2000). Organic Chemistry. John Wiley & Sons.

Morrison, R.T., Boyd. R.N. (1987). Organic Chemistry. 5th Ed.Allyn & Bacon. Inc.

LEVEL TWO

ATOMIC STRUCTURE AND BONDING

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the basic principles and concepts of quantum numbers and bonding theories.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Describe the Bohr atom.
2. Relate the dependence of energy levels of hydrogen atom to principle quantum number.
3. Relate the significance of the Schrödinger equation and the wave equation.
4. Discuss the principles of the valence bond and molecular bond theories.

Course Content

Primary particles of chemical interest; Isotopes; Particle wave duality, de Broglie relationship; The Bohr atom; wave functions; the Schrödinger equation, and solutions for the hydrogen atom; shapes of orbitals: s, p and d; Magnetic and electron quantum numbers; Hund's rule; Pauli exclusion principle; Aufbau principle leading to the periodic table; Many-electron atoms; need for Slater effective atomic numbers, penetration and shielding. Chemical bonding, ionic and covalent character, dipole moments. Molecular orbital theory; LCAO approximations, bonding and antibonding orbitals, bond order; Delocalisation. Valence bond theory: Hybridisation, symmetry, overlap, resonance. Comparison of valency bond theory and molecular orbital descriptions; shapes of molecules. The solid state: crystal geometry and structure. Lattice energy calculations. Solvation energies. Born Haber cycle. Metallic bonding. Insulators, semi-conductors. Defects in crystalline solids. The bond theory of metals. Complexions, definitions and examples of acids and bases, coordinate bond.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Cotton, F.A. and Wilkinson, G. (1988). Basic Inorganic chemistry, 5th Edition. Wiley Interscience.

Housecroft, C.E. (2001). Inorganic chemistry. Prentice Hall.

Kapoor, R., Vasisht, S.K. and Chopra, R.S. (2000). Inorganic Chemistry. R. Chand & Co. Publishers.

Lee, J.D. (2006). *Concise Inorganic Chemistry*. 5thd. Blackwell Science Ltd.

Shriver, D.F., Atkins, P.W. and Lengford, C.H. (1990). Inorganic chemistry. ELBS, Oxford.

INTRODUCTION TO KINETICS AND THERMODYNAMICS

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the kinetic theory of gases, chemical thermodynamics and reaction mechanisms for various reactions.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Discuss kinetic theory of gases
2. Discuss the first law of thermodynamics
3. Apply various methods to determine rates and orders of chemical reactions.
4. Propose mechanisms for enzyme catalysed reactions

Course Content

Properties of gases, kinetic theory of gases, ideal gas laws, deviation from ideality and Van der Waals equation. Derivation of heat capacities (C_v and C_p) from the kinetic theory of gases. Liquefaction of gases, Law of corresponding states and the critical point. Reaction Kinetics: elementary and complex reactions, molecularity of elementary reactions. Introduction to reaction order and rate equations. Order of reaction, rate of reaction, reversible reaction. Rate-determining step and integrated rate laws for zero, first and second-order reversible reactions. Rate constants and half life. Dependence of rate constant on temperature, activation energy. Methods of determining rates and orders of chemical reactions. Qualitative treatment of Boltzmann factor. Catalysis: heterogeneous catalysis, enzyme catalysis (Michaelis constant), homogeneous catalysis. Introduction to chemical thermodynamics: systems, states, state functions, and the equilibrium state. First law of thermodynamics: internal energy, enthalpy, constant volume, constant pressure. Pressure, volume, work and reversible processes. Isothermal and adiabatic expansion and compression of an ideal gas. Heat capacities and temperature dependence of internal energy and enthalpy. Thermochemistry: Basic definition of enthalpy changes, heat

change involved in chemical reactions, heats of formation, combustion, neutralization and solution. Hess's law.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Atkins, P., de Paula, J. (2006). Physical Chemistry. 8th Ed. Oxford.

Laider, K.J., Meiser, J.H., Sanctuary, B.C. (2003). Physical Chemistry. 4th Ed. Houghton Mifflin.

Levine, I.N. (2002). Physical Chemistry. McGraw Hill.

CHEMICAL THERMODYNAMICS AND PHASE EQUILIBRIA

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the second and third laws of thermodynamics and phase equilibria.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Apply second and third laws of thermodynamics in solving problems
2. Apply phase equilibria to describe solutions

Course Content

Spontaneous processes in isolated systems. Entropy and disorder. Second Law of thermodynamics. Spontaneous isolated systems. Calculation of entropy for isothermal processes. Temperature dependence of entropy. Free energy and chemical equilibrium in multi-phase and multi-component systems. Gibbs and Helmholtz free energy, the pressure and temperature dependence of Gibbs free energy. Relation of Gibbs free energy to equilibrium constant. Third Law of thermodynamics. Clausius, Clausius-Clapeyron and Van't Hoff isochore equations. Phase rule. Phase equilibria, Vapour pressure composition diagrams for liquid mixtures. Properties of solutions. Raoult's and Henry's Laws; azeotropes, eutectics; applications to ideal and non-ideal systems and industrially important processes including distillation and chemical equilibria at high temperatures and pressures. Distillation colligative properties.

Learning and Teaching Methods

Lecture, Discussion, Practicals, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Atkins, P.W. (2001). Physical chemistry, 7th Edition. Oxford university press.

Smith, C.B., (1998). Basic chemical thermodynamics, 5th Edition. Oxford University press.

CHEMICAL ANALYSIS AND STRUCTURAL DETERMINATION

Credit hours: 3

Course Purpose

The purpose of this course is to equip learners with sampling techniques and develop skills in handling analytical instruments and interpretation of data.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Apply the skills in sample collection
2. Describe analytical techniques used in analysis.
3. Carry out practical exercises by handling instruments and interpretation of data competently.

Course Content

Theory and use of analytical instruments: Optical methods. Applications of the techniques in analysing compounds. Emission spectroscopy. X-rays methods. Electrochemical methods. Chromatographic techniques. In each component of the course, instructions and practical work on the skills of handling instruments, acquisition of spectra and data interpretation will be emphasized.

Interphase between chromatography and spectrometric techniques: Nuclear magnetic resonance (NMR)–Mass spectrometry (MS)-infrared(IR)-gas chromatography (GC), i.e., LC-GC, LC-MS, GC-IR, LC-NMR, MS-MS, LC-NMR-MS. Ionisation modes; electroionisation, electro-spray ionisation, fast atom bombardment ionisation, atmospheric pressure chemical ionisation, matrix assisted laser desorption ionisation. Instrumentation of MS, NMR, Tandem Mass Spectrometry. Selected ion MS, Selected ion monitoring Fourier transformation (FT). Qualitative analysis. Applications.

Learning and Teaching Methods

Lecture, Practicals, Discussions, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Miller, J.C. and Miller, J.R. (1988). Statistics for Analytical Chemistry, 3rd Edition. Ellis Horwood Ltd.

Hadjiioannou, T.P, Christian, G.D., Etstathion, C.E and Nikolelis, D.P. (1998). Problems for analytical chemistry. Pergamon Press.

Underhood, A.L. and Day, R.A. (2001). Quantitative analysis. Prentice Hall, 8th Edition.

Skoog, D.A., West, D.M., Holler, F.J., Crouch, S.R. (2004). Fundamentals of Analytical Chemistry. 8th Ed. Thomson.

LEVEL THREE

CHEMISTRY OF THE S-AND P-BLOCK ELEMENTS

Credit hours: 3

Course Purpose

The purpose of this course is to equip the learner with the knowledge on the chemistry of s-and p-block elements

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Discuss the physical and chemical properties of s and p block elements**.**
2. Explain allotropism and properties of hydrides, oxides, hydroxide, oxoacids and salts of s- and p- block elements**.**
3. Describe the chemistry of boranes

Course Content

General survey of the main features of the s-and p-Block elements important formal oxidation states of various elements. Occurrence and metallurgy. Some examples of applications of the elements and their compounds. Comparative study of the chemistry as illustrated by allotropism; binary compounds, hydrides, oxides, hydroxide, oxoacids and salts, with comparisons along periods, down the groups and diagonally. The borane chemistry. Practical work to include systematic identification of cations and anions and selected preparative experiments.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Course Texts

Cotton, F.A. and Wilkinson, G. (1988). Advanced Inorganic chemistry, 5th Edition. Wiley Interscience.

Housecroft, C.E. (2001). Inorganic chemistry. Prentice Hall.

Huheey, J.E., Keiter, E.A and Keiter, R.L. (1993). Inorganic chemistry: Principles of structure and reactivity, 4th Edition. Happer Collins.

Lee, J.D. (2006). A new concise inorganic chemistry. 5th Ed.

Shriver, D.F., Atkins, P.W. and Lengford, C.H. (1990). Inorganic chemistry. ELBS, Oxford.

ORGANIC SYNTHESIS

Credit hours: 3

Course Purpose

The purpose of this course is to equip learners with the principles and strategies in the synthesis of organic compounds.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Explain interconversion of various functional groups
2. Strategize and design synthetic routes in organic synthesis.

Course Content

Principles and Strategy. Interconversion of Functional Group. Linear and Convergent Synthesis. Strategies for the Synthesis of C-C bond: nucleophilic addition to carbonyl, conjugate addition,

enolate chemistry, stereoselective aspects of alkylation, kinetic and thermodynamic control, Wittig reaction, Diels-Alder reaction. Strategies for the synthesis of C-N, C-S and C-P bonds.

Retrosynthetic analysis and design of synthetic routes in organic synthesis. Method of forming cyclic and alicyclic carbon bonds: aldol, Grignard, Witting and acyloin condensation, the Dieckmann cyclization and the Diels-Alder reaction. Carbon-oxygen and carbon-nitrogen bond formation. Dissolving metal, metal hydride, diimide and catalytic reductions. Addition reactions to alkenes and alkynes, synthesis of alkenes, Witting reaction and eliminations. Synthesis of alkynes by witting reaction and eliminations. Synthesis of alkynes. Rearrangement reactions. Carbocation, carbanion, claisen, cope Demyanov, Rayostic, Beckman and Fries rearrangements. Advanced oxidation reactions. Improved methods for oxidation such as the use of crown ethers. Hydroboration and stereochemistry. Bayer-Villager reactions, epoxidations. Use of protecting groups in organic synthesis.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Bruice, P.Y. (2004). Organic chemistry. Pearson Prentice Hall, 4th Edition.

Engel, R. And Baker, A.D. (1992). Organic chemistry. West Publishing Co.

McMurry, J. (1992). Organic Chemistry. Brooks/Cole. 3rd Edition.

Morrison, R.T. and Boyd, R.N. (2001). Organic Chemistry. Allyn and Bacon, 6th Edition.

HETEROCYCLIC AND STEREOCHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the chemistry of non aromatic heterocyclic and aromatic compounds and their synthesis.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Discuss the chemistry of heterocyclic compounds.
2. Discuss substitution reactions in aromatic compounds
3. Carry out bioassay of biologically active compounds
4. Describe stereo selective reactions.
5. Identify stereochemistry of isomers using NMR.

Course Content

Nomenclature of non-aromatic heterocyclic compounds. Review of chemistry of the pyrroles, furans, thiophenes, pyridines, indoles. N-heterocycles of medicinal importance. Small rings: aziridines, β-lactams, alkaloids and other structural types; O-heterocyclics. Simple 3,4,5,6-membered ring heterocycles, their synthesis and properties. Heteroaromatics: General survey of importance. Comparison of rings containing heteroatoms; mechanistic aspects of electrophilic substitution; synthesis and properties. Pyridine derivatives as synthetic intermediates. Fused rings such as indole, quinolines, benzothiophene, carbazole, dibenzothiophene, acridine; their reactions and derivatives. Emphasis on the biologically active compounds and their synthesis.

Electrophilic aromatic substitution reactions of benzene: General mechanism, halogenations, nitration, sulphonation, Friedel-Crafts alkylation and acylation reactions. Reactions of substituted benzenes: Side chain reactions of alkyl benzenes, functional group transformations (e.g., reduction of nitro group to amino group), electrophilic aromatic substitution (effect of substituent on reactivity and orientation). Nucleophilic aromatic substitution reactions. Benzyne. Conformation and configuration. Stereoselective reactions of cyclic compounds: small rings, stereochemical control in six-membered rings, conformational control in formation of six-membered rings. Diastereoselectivity: making single diastereoisomers using stereospecific reactions of alkenes. Stereoselective reactions. Prochirality. Diastereoselectivity in carbonyl addition. Effect of chelation. Stereoselectivity in aldol reactions. Determination of stereochemistry by spectroscopic methods: conformational analysis of both cyclic and acyclic systems.

Practicals to include the use of NMR to determine stereochemistry of isomers.

Learning and Teaching Methods

Lecture, Discussion, Practicals, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Material and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Bruice, P.Y. (2004). Organic chemistry. Pearson Prentice Hall, 4th Edition.

Clayden, J., Greeves, N., Warren, S., Wthers, P. (2007). Organic Chemistry. Oxford.

Engel, R. and Baker, A.D. (1992). Organic chemistry. West Publishing Co.

McMurry, J. (1992). Organic Chemistry. Brooks/Cole. 3rd Edition.

Morrison, R.T. and Boyd, R.N. (2001). Organic Chemistry. Allyn and Bacon, 6th Edition.

Morrison, R.T., Boyd, R.N. (1987). Organic Chemistry. 5th Ed.Allyn & Bacon. Inc.

CO-ORDINATION CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to equip learners with development and theories of coordination chemistry.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Describe the structure and isomerism of co-ordination compounds
2. Explain reaction mechanisms of inorganic chemistry
3. Describe the bonding theories of metal-ligand bonds

Course Content

Introduction: Coordinate bond, electronic configurations of d-block elements. Hard and soft acids and bases (HSAB) concept and their applications. Development of co-ordination chemistry; Blomstrand-Jörgensen and Werner's theories. Coordination number and geometry. Ligands. Nomenclature, structure and isomerism in co-ordination compounds. Rates and reaction mechanisms of inorganic chemistry: Brief survey, lability and inertness, substitution- octahedral and square planar (trans effect), Dissociative, redox or electron transfer. Theories of metal-ligand bonding. Preparation and stability of co-ordination complexes. Applications: Monodentate and multidentate, chelating agents and bioinorganic.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Cotton, F.A. and Wilkinson, G. (1988). Advanced Inorganic chemistry, 5th Edition. Wiley Interscience.

Kettle, S.F.A. (1988). Physical inorganic chemistry; Coordination chemistry approach. Oxford university press.

Housecroft, C.E. (2001). Inorganic chemistry. Prentice Hall.

Huheey, J.E., Keiter, E.A and Keiter, R.L. (1993). Inorganic chemistry: Principles of structure and reactivity, 4th Edition. Happer Collins.

Shriver, D.F., Atkins, P.W. and Lengford, C.H. (1990). Inorganic chemistry. ELBS, Oxford.

LEVEL FOUR

TRANSITION METAL CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce students to the splitting of d-orbitals and interpretation of spectra.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Derive the ground state term symbols and explain the selection rules of electronic transitions
2. Interpret Tanabe-Sugano and Orgel diagrams for different electron configurations
3. Describe the molecular structures and bonding in metal carbonyls, nitrosyls and molecular nitrogen

Course Content

Introductory survey: structure and colours of transition metal compounds, charge transfer spectra; Metal-metal bonding and cluster compounds; Descriptive chemistry of selected groups of transition metals: occurrence, extraction, physical and chemical properties; Energy levels in metal complexes and their consequences; Common oxidation states, stabilization of unusual states; spectrochemical series; splitting of d-orbitals, crystal field stabilization energy; structures and reaction of halides and halo-complexes, aquo ions, hydroxo-and oxo-complexes. Spectra: coupling, ground state term symbols, hole formalism, microstates, selection rules, splitting of electronic energy levels and spectroscopic states, spectra of ions, Tanabe sugano diagrams. Metal carbonyls, nitrosyls and molecular nitrogen: Application of spectroscopic studies to predict structures and stabilities. Practical applications of selected oxides such as TiO_2 in paints, MnO_2 in making of dry cells, CrO_2 in magnetic tapes, Cr_2O_3 and CoO in ceramics; Selected catalytically important reactions such as polymerization of olefins or cis-isoprene to make polythenes or rubber respectively using Ziegler-Natta catalysts, hydrogenation of oils to make margarine and other edible fats, manufacture of ammonia in the Haber-Bosch process and manufacture of sulphuric acid.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%

Total 100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Cotton, F.A. and Wilkinson, G. (1988). Advanced Inorganic chemistry, 5th Edition. Wiley Interscience.

Housecroft, C.E. (2001). Inorganic chemistry. Prentice Hall.

Huheey, J.E., Keiter, E.A. and Keiter, R.L. (1993). Inorganic chemistry: Principles of structure and reactivity, 4th Edition. Happer Collins.

Portefield, W.W. (1984). Inorganic chemistry: A unified approach. Addison-Wesley.

Purcell, K.F. and Koltz, J.C. (1977). Inorganic chemistry, International edition. Saunders Philadelphia.

Yamamoto, A. (1986). Organotransition metal chemistry: Fundamental concepts and applications. Wiley New York.

INDUSTRIAL CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce learners to local chemical industrial processes and environmental implications.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Describe chemical processes in various chemical industries
2. Discuss environmental impacts of the chemical industries

Course Content

Ceramic industries: Ceramic products; refractories; glass. Portland cement and calcium carbide. Production, uses and analysis of selected important chemical processes such as sodium chloride, ammonia, nitric acid, sulphuric acid, caustic soda, soda ash, chlorine and their products. Processing of fats and oils for edible use and industrial applications. Isolation of meat by-

products. Manufacture of soaps, detergents, paints and tanning. Production and isolation of wood chemicals. The pulp and paper industry. Extraction and purification of metals such as aluminium production. Locally available raw materials for the chemical industry and their further processing. Agrochemicals: Chemistry of Fertilizers i.e. ingredients, additives and stabilizers, Processing of fertilizers quality control methods, toxicology, packaging and storage. Chemistry of pesticides e.g. fungicides, herbicides, insecticides etc. Ingredients, additives and stabilizers. Processing of pesticides, quality control methods, toxicology, packaging and storage. Petroleum refining including heavy oil and bitumen; cracking, reforming, petrochemicals, feedstock for chemical industry and formation of industrial chemicals. Industrial organic synthesis including monomers for subsequent polymerization. Design of specialized polymers. Rubber industry. Dyes: Making matches and bleaches. Fermentation and fermentation based products such as ethanol and penicillin. Rubber industry. Starch industry. Sugar processing in Kenya. Pharmaceuticals and health care products; Types, synthesis and importances. Effects of chemical plants on the environment, safety and chemical waste management. The chemistry involved in the processes will be emphasized. Students will be required to visit selected industrial sites.

Learning and Teaching Methods

Lecture, Practicals, Discussions, Exercises Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment
Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Meyer, L.H. (1990). Food chemistry. CBS publishers and distributors.

ENVIRONMENTAL CHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to equip students with knowledge on environmental pollution, abatement strategies taken to curb pollution and regulations guiding industries in Kenya.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Discuss the origin of the earth
2. Discuss environmental pollution
3. Outline principles of green chemistry.

Course Content

Origin of elements and interstellar molecules: The development of the solid earth; chemical evolution and origin of life. Environmental pollution. Atmospheric and photochemistry of major gaseous pollutants. Acid rains. Fossil fuels. Production of oxides of carbon, nitrogen and sulphur from fossil fuels. New energy sources: solar, biogas, geothermal, microwave. Nature and potential toxicity of particulate and gaseous emissions from the combustion of petroleum based fuels. Lead fuel additives as potential health hazards. Recent developments in emission control such as catalytic converters. Impact of agricultural chemicals on terrestrial and aquatic environments. Persistence of pesticide residues in tropical ecosystems and temperate climates. Effects of pesticide residues on food chains, eutrophication and environmental health implications. Industrial, agricultural and domestic toxic wastes and their environmental waste disposal methods. Environmental impact such as integrated use of microorganisms in solid waste management, biological pest control, reuse and recycling, purification of waste water and contaminated air. Environmental regulations guiding Kenyan industries on environmental pollution. Green Chemistry: Principles and application.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Environmental Control and Public Health Air Quality Management Units 14-16.

Moore, J.W., Moore, E.A. (1985). Environmental Chemistry. 2nd Ed. Academic Press, New York.

Stoker, H.S., Seager, S.L. (1976). Environmental Chemistry: Air and Water Pollution. 2nd Ed. Scott Foresman & Co, Illinois.

Vanloon G.W., Duffy, S.J. (2001). Environmental Chemistry. A Global Perspective. Oxford.

ELECTROCHEMISTRY

Credit hours: 3

Course Purpose

The purpose of this course is to introduce learners to methods of conductivity measurements, laws, theories and electrode mechanisms.

Expected Learning Outcomes

At the end of the course, the students should be able to:

- Explain the terms used in electrochemistry
- Apply the theories and laws in electrochemistry in solving problems.

Course Content

Conductance of electrolytes, specific resistance and conductance, molar and equivalent conductance and cell constant. Conductivity: methods of measurements, relation to diffusion coefficent; measurement of transport numbers; factors affecting ionic mobility; conductance of strong and weak electrolytes; Debye-Hückel theory; Onsager limiting law, Kohlrausch's measurements, determination of dissociation constant of weak acids. Solubility of sparingly soluble salts, electrolysis. Transference number and conductometric titrations. Electrochemical process, electrode potentials, application of emf measurements. Standard cell. Electrochemical cell: sign convention, dependence of the emf on concentration and activity coefficients, equilibrium and pH. Solubility product, free energy and enthalpy from emf measurements. Concentration cells with and without liquid junctions, potentiometric titrations, amperometry, chronopotentiometry. Reactions at electrodes; ionic activities and activity coefficients; emf determination. Nernst equation; types of electrodes; electrode mechanisms, transport limited currents, rotating disk, mercury drop, analytical applications.

Learning and Teaching Methods

Lecture, Practicals, Discussion, Exercises, Tutorials.

Mode of Assessment

Type	Weighting
Examination	70%
Continuous Assessment Tests	30%
Total	100%

Instructional Materials and/or Equipment

Chalk and Chalkboard, Pen/whiteboard, Power Point/LCD, Laboratory manuals, Laboratory equipment and Apparatus.

Course Texts

Atkins, P.W. (2001). Physical chemistry, 7th Edition. Oxford university press.

Glasstone, S. (1991). An introduction to Electrochemistry. Litton Education Publishers.

5.5 MATHEMATICS COURSES

The Mathematics courses will each be 3 credits and will be evaluated as follows;

Course Assessment

Type	**Weighting**
Written CATS and assignments	30%
End of Semester Examination	70%
Total	100%

LEVEL ONE

BASIC MATHEMATICS AND ANALYTIC GEOMETRY.

Credit hours: 3

Pre-requisite - None.

Purpose of the Course

To link the concepts learned in high school mathematics by the students to certain basic concepts essential in developing university mathematics.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Compute accurately the distance from a straight line to a point on the Cartesian plane.
2. Obtain the standard and general equations of a circle, parabola, hyperbola and ellipse.
3. Solve problems involving, counting, the conic sections and trigonometric functions.
4. Transform equations from Cartesian to polar co-ordinates and vice versa.
5. Accurately sketch the graphs of given trigonometric functions.
6. Use the factor and remainder theorems to factorize given functions and solve problems that involve these theorems.

Course Content

Distance from point to a line, angle between straight lines. Circles: Standard equation, equation of tangent, length of tangent from external point. Orthogonal circles. Conic Sections (Parabola, ellipse, hyperbola): Definitions, standard equations, graphs, analysis, tangent and normal.

Polar and parametric equations: Conversions from polar to rectangular and vice versa. Polar and parametric equations of conic sections. Trigonometric and hyperbolic functions: Graphs and their inverses, trigonometric identities, addition and multiple angles. Factor and Remainder theorems and their applications. Counting axioms including permutations and combinations.

Recommended references

Backhouse J. K, Houldworth S.P.T and Cooper B.E.D (2002), *Pure Mathematics 1*. Cambridge University Press, ISBN-13: 9780521530118.

George B. Thomas and Ross L. Finney (1988), *Calculus and Analytic Geometry*. Addison-Wesley Publishing Company, New Jersey. ISBN 0-201-16320-9

Howard L. Rolf, (1999), *Finite Mathematics*, Fourth Edition, Saunders College Publishing, Orlando Florida, USA. ISBN 0-03-021314-2

Steven Roman, (1989), *An introduction to Discrete Mathematics*, Second Edition, Harcourt Brace Jovanovich Publishing, Orlando Florida, USA. ISBN 0-15-541730-4.

DIFFERENTIAL CALCULUS

Credit hours: 3

Pre-requisite-None

Purpose of the Course

The purpose of the course is to introduce the students to the concept of limits, derivatives and their applications.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Determine the domain and range of a given function.
2. Compute limits of given functions and derivatives from first principles
3. Use the right technique to compute the derivative of a given function.
4. Solve problems involving derivatives.
5. Determine the linear and quadratic approximations of given functions.

Course Content

Functions: Domain and range, composition of functions, properties of functions. Limits: Definition, techniques of evaluating limits, continuity, one sided limits, limits at infinity.

Differentiation: Definition, differentiation using definition, properties of derivatives. Techniques of differentiation: power rule, product rule, quotient rule, chain rule, trigonometric functions, exponential, logarithmic, implicit, hyperbolic, parametric, inverse functions. Higher order derivatives. Applications of derivatives: Increasing/decreasing functions, concavity, curve sketching and asymptotes. Tangent and normal. Related rates. Optimization(applied maximum and minimum). Mean value theorem, indeterminate forms and L'Hospital rule. Linear and quadratic approximations.

Recommended references

Backhouse J. K, Houldworth S.P.T and Cooper B.E.D (2002), *Pure Mathematics 2*. Cambridge University Press, ISBN 0-582-35387-4

Dale Varberg, Edwin Purcell, Steven Rigdon (2000), *Calculus.* Prentice Hall, ISBN 0-13-085149-3

George B. Thomas and Ross L. Finney (1988), *Calculus and Analytic Geometry* . Addison-Wesley Publishing Company, New Jersey. ISBN 0-201-16320-9

James Stewart and James Brown(2003). *Calculus and Early Vectors,* Cengage Learning, ISBN-13: 9780534493486.

Ron Larson, Robert Hostetler, Bruce Edwards(2003) , *Calculus.* Houghton Mifflin Company. ISBN 0-618-22307-X.

INTRODUCTION TO PROBABILITY AND STATISTICS

Credit hours: 3

Pre-requisite-None

Purpose of the Course

The purpose of this course is to introduce students to the concepts of statistics and probability.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Represent data accurately using the right techniques
2. Compute measures of central tendency, location, dispersion, skewness and kurtosis.
3. Interpret the measures of central tendency, location, dispersion, skewness and kurtosis.
4. Solve problems involving basic probability.
5. Determine if a given bipartite data has linear relation and compute the regression line.

Course Content

Descriptive Statistics: Definition of data, statistic, elements and variables. Sources and methods of data collection. Representation of data; bar graphs, pie charts, frequency distributions, relative frequency distributions, histograms, cumulative frequency distribution curves (ogive), stem and leaf display. Measures of central tendency; mode, median, mean including geometric and trimmed mean. Measures of location; quartiles, deciles, percentiles. Measures of dispersion; range, inter-quartile range, standard deviation, coefficient of variation. Skewness and Kurtosis. Introduction to probability; experiments, sample space, event, probability of event, conditional probability, independence, addition and multiplication rules. Bayes rule. Probability distributions; Bernoulli, Binomial, Poisson, hyper geometric, normal. Approximation of Binomial using Poisson and normal. Expected value and variance. Linear regression and correlation; Scatter plots, Pearson's product and Spearman's rank correlation coefficient. Least square regression line.

Recommended references

Jay L. Devore, Probability and Statistics for Engineering and the Sciences, (2004), Brooks/Cole Publishing, Belmont, USA. ISBN 0-534-39933-9

Mario F. Triola (2001), *Elementary Statistics*, Addison- Wesley Publishing Company. ISBN 0-201-61477-4.

Morris H. DeGroot(1989), *Probability and Statistics*, Addison- Wesley Publishing Company, Reading, USA. ISBN 0-201-11366-X.

LINEAR ALGEBRA I

Credit hours: 3

Pre-requisite-None

Purpose of the Course

The course introduces students to the concept of vectors, vector spaces, matrices, solutions of linear systems and linear transformations.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Perform elementary matrix operations of addition, subtraction and multiplication.
2. Compute the determinants of square matrices of order up to 4x4.
3. Find the inverse of an invertible matrix using cofactors and augmented matrices.
4. Solve systems of linear equations in several variables.
5. Perform elementary operations on vectors and determine if given vectors are linearly independent or dependent.
6. Determine if given sets are subspaces of a vector space or not.
7. Determine if a given transformation is linear or not.
8. Find the matrix representation of a linear transformation relative to a given basis.

Course Content

Matrices: Order, addition, subtraction, scalar multiplication and matrix multiplication, row echelon forms. Determinants; Properties, determinants for general square matrices by permutation and cofactor methods. Inverse of square matrix. Systems of linear equations; solution by substitution, and elimination method. Gauss Jordan elimination method, Crammers rule, inverse matrix method. Vectors; addition, scalar multiplication, dot and cross products, magnitude. Vector Spaces; Definition and examples, subspace, linear independence and dependence, basis and dimension. Linear transformation: Definition and examples, matrix representation relative to standard basis, range and kernel (null space), rank and nullity.

Recommended references

Berbard Kolman, *Elementary Linear Algebra*, 6th edition, Prentice Hall, New Jersey, ISBN 0-13-374729-8

Howard Anton, (1991), *Elementary Linear Algebra*, 6th edition, John Wiley & Sons, New York, USA, ISBN 0-471-50900-0.

Howard L. Rolf, (1999), *Finite Mathematics*, Fourth Edition, Saunders College Publishing, Orlando Florida, USA. ISBN 0-03-021314-2

Peter J. Olver and Chehrzad Shakiban (2006), *Applied Linear Algebra*, Prentice Hall, New Jersey, ISBN 0-13-147382-4.

LEVEL TWO.

INTEGRAL CALCULUS

Credit hours: 3

Pre-requisite- Differential Calculus

Purpose of the Course

The course is introduces the student to concept of anti-derivatives, definite integrals and their applications.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Use the correct technique of integration to find the anti-derivative of a given function.
2. Evaluate definite integrals using anti-derivatives and Riemann Sums.
3. Use Numerical integration techniques to approximate definite integrals.
4. Solve problems involving integrals.
5. Apply integration in solving real life problems.

Course Content

Antiderivates and indefinite integrals. Riemann sums and definite integrals. Fundamental theorem of Calculus. Techniques of integration: Power rule, substitution, trigonometric functions, integration by parts including tabular form, partial fractions, trigonometric substitution. Powers and products of sines and cosines.

Applications of integration: Area between curves, Volumes of revolution: Disk, Washer and cylindrical shells method, arc length, surface area of revolution. Real life problems involving integration. Numerical integration: Trapezoidal and Simpson's rule.

Recommended references

Dale Varberg, Edwin Purcell, Steven Rigdon(2000), *Calculus.* Prentice Hall, ISBN 0-13-085149-3

George B. Thomas and Ross L. Finney (1988), *Calculus and Analytic Geometry* . Addison-Wesley Publishing Company. ISBN 0-201-16320-9

James Stewart, James Brown(2003), *Calculus and Early Vectors,* Cengage Learning, ISBN-13: 9780534493486.

Ron Larson, Robert Hostetler, Bruce Edwards(2003) , *Calculus.* Houghton Mifflin Company. ISBN 0-618-22307-X

ORDINARY DIFFERENTIAL EQUATIONS

Credit hours: 3

Pre-requisite- Integral Calculus

Purpose of the Course

The course would expose students to the concept of differential equations, their formation, solutions and applications to real life.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Classify a given differential equation into ODE or PDE, order, degree, and linearity.
2. Form the differential equation associated to a given primitive or family of curves.
3. Determine the nature of a given first order differential equation and solve it.
4. Solve problems involving differential equations in growth, decay, geometry, heating and cooling, etc.
5. Solve homogenous differential equations of nth order with constant & variable coefficients.
6. Reduce linear differential equations to homogenous differential equations with constant using specified substitutions where possible.
7. Use the Eulers equations, Methods of Undetermined coefficients and Variation of Parameters to solve non-homogenous differential equations.
8. Solve problems involving nth order differential equations by the power series method near an ordinary point.

9. Solve systems of linear differential equations.

Course Content

Classification of differential equations. Differential equations associated to primitive equations. First order differential equations: separable, homogeneous, near homogeneous, exact, integrating factors for exactness, linear, Bernoulli. Applications of first order differential equations. Second and higher order differential equations: homogeneous with constant coefficients. The Wronskian and its significance in solution of differential equations.

Uniqueness and existence of solutions. Non-homogeneous differential equations: Eulers equations, Method of undetermined coefficients and variation of parameters. Application to simple harmonic motion and real life problems. Power series solutions at ordinary points. Systems of linear differential equations.

Recommended references

Charles G. Cullen, Linear & Differential Equations, (1989), Prindle, Weber & Schmidt, Boston, USA. ISBN 0-87150-262-3

Kreyszig John, *Advanced of Engineering Mathematics*, Fifth Edition, (1994), John Wiley & Sons, New York, USA. ISBN: 81-224-0016-7.

Richard Bronson, *Theory and Problems of Differential Equations,* McGraw-Hill, Schaum's Outline Series, New York, USA. ISBN: 0-07-007979-X.

COMPLEX ANALYSIS I

Credit hours: 3

Pre-requisite- None

Purpose of the Course

The course develops the concept of complex numbers and functions together with their properties.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Find the limit of a complex valued function at a specified value.
2. Determine if a given complex function is continuous in a given region or specified point.

3. Use the Cauchy Riemann equations to determine if a given function is differentiable or not.
4. Solve problems involving elementary complex functions.
5. Test if a given function is harmonic and find its harmonic conjugate.
6. Find the singularities of a complex function specifying their nature.
7. Integrate complex functions along specified curves from one point to another
8. Expand a given complex function into a Laurent series valid in a specified region and determine the analytic and principal parts.
9. State and proof Cauchy's theorems.
10. Find the residue of a complex function at its poles.

Course Content

Complex numbers: addition, subtraction, multiplication, division, conjugate, absolute value, complex plane and geometric representation, polar form, powers and roots, nth roots of unity.

Elementary complex functions: polynomial, exponential, trigonometric, hyperbolic, logarithmic, inverse trigonometric, inverse hyperbolic.

Differentiation of complex functions: limits, continuity, derivatives, Cauchy Riemann equations, harmonic functions.

Complex integration: Contour and line integration, Cauchy's integral theorem and formula for nth derivative. Cauchy's residue theorem.

Laurent series and residue at a singularity.

Recommended reference material

John B. Conway., *Functions of one complex variable*

Lars V. Alfors, *Complex Analysis, an introduction to theory & analytic functions of one complex variable.*

Murray R. Spiegel, Theory and Problems in Complex Analysis, Schaum's Series :

Ruel V. Churchil and James Ward Brown, *Complex variables and applications*

REAL ANALYSIS I

Credit hours: 3

Pre-requisite- None

Purpose of the Course

The course exposes students to the idea of real numbers and metric spaces, countability, series and sequences and tests for convergence.

Expected Learning Outcomes

At the end of the course, the students should be able to:

1. Find limits of functions, sequences and series using the epsilon, delta language.
2. Differentiate between countable and uncountable sets and determine if a given set is countable or not.
3. Find the supremum and infimum of a bounded set.
4. Use the correct technique to test if a given sequence converges or not.
5. Determine if a given function is continuous, uniformly continuous or not.
6. Determine if a given function is a metric and determine the neighbourhood in a specified metric.

Course Content

Set theory: Set builder notation, union, intersection, difference, De Morgan laws.

Real numbers: Bounded and unbounded sets, supremum and infimum, completeness axiom, interior and exterior, open and closed sets, closure of a set, countable and uncountable sets. Neighbourhoods. Sequence and series: Limit point, limit inferior and superior, convergent sequence, monotone sequence, subsequence, Cauchy sequence. Series: Tests of convergence, Cauchy's root test, D'Alberts ratio test, integral test, alternating series test. Absolute and conditional convergence of series. Real valued functions: limit of a function, continuity and uniform continuity. Metric spaces: definition, examples, neighbourhoods in metric spaces.

Recommended references

Brian S. Thomson, Judith B. Bruckner and Andrew M. Bruckner, (2001), Prentice Hall, Elementary Real Analysis, Prentice Hall, New Jersey, ISBN 0-13-019075-6.

Charalambos D. Aliprantis and Owen Burkinshaw, (1990), Principles of Real Analysis, Academic Press, San Diego, USA, ISBN 0-12-050255-0.

Edward D. Goughan, (1975), Introduction to Analysis, Second Edition, Brooks/Cole Publishing Company, Monterey, USA. ISBN 0-8185-0172-3.

William O. Ray, (1988), Real Analysis, Prentice Hall, New Jersey, ISBN 0-13-762386-0.

LEVEL THREE

At level three, students should choose four courses in their area of specialization. The areas of specialization are Pure Mathematics, Applied Mathematics and Statistics.

PURE MATHEMATICS COURSES

- Real Analysis II
- Group theory
- Ring theory
- Linear algebra II
- Algebraic structures.
- Number theory

APPLIED MATHEMATICS COURSES

- Real Analysis II
- Numerical Analysis I
- ODE II
- Dynamics
- Analytic applied Mathematics
- Fluid Mechanics

STATISTICS COURSES.

- Multivariate probability distributions.
- Theory of estimation.
- Operations research
- Tests of Hypothesis
- Sample survey
- Quality Control methods

Level Four

At levels four, students should choose four courses in their area of specialization as done during the level 3.

PURE MATHEMATICS COURSES

- Topology
- Field theory
- Galois theory
- Complex analysis II
- Functional Analysis
- Measure theory & integration
- Coding theory

APPLIED MATHEMATICS COURSES

- Numerical Methods
- Differential Geometry
- PDE
- Fluid flow analysis
- Methods of fluid mechanics
- Complex analysis II

STATISTICS COURSES.

- Stochastic processes
- Design and analysis of experiments
- Multivariate methods
- Measure & probability
- Systems analysis & design.
- Time series analysis

5.6 PHYSICS COURSES

LEVEL ONE

MECHANICS

Credit Hours: 3

Pre-requisite: None

Purpose of the Course

The purpose of this course is to introduce students to the theory and concepts of mechanics and discuss important experiments in the development of physics. The students will be introduced to the main ideas of mechanics and teach them the basic mathematical methods and techniques used in the field of mechanics.

Expected learning outcomes

At the end of this course, students should be able to:

1. Describe the connection between force and motion, through Newton's laws.
2. Demonstrate a practical understanding of conservation laws and their use.
3. Perform mechanics experiments and write laboratory reports.

Course Content

Vectors; Composition and resolution of coplanar vectors. Forces and equilibrium. Free-body diagram techniques. Moments, couple and torque. Particle kinematics. Newton's laws and particle dynamics. Circular motion of particles. Work and energy, linear and angular momentum. Conservation laws. Potential energy. Central forces. Planetary motion. Mechanics of systems of particles and rigid bodies.

Mode of Delivery

Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, projector for power point presentation, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

Halliday D. Resnick, R. and Walker J, (2007). Fundamentals of Physics (8th Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Sears F. W., Zemansky M. W. and Young H. D.,(). University Physics, Addison Wesley (any edition).

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

HEAT AND THERMODYNAMICS

Credit Units: 3

Pre-requisite: None

Purpose of the Course

The purpose of the course is to introduce students to the theory and concepts of Heat and thermodynamics and discuss experiments encountered in this branch of physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Describe how heat is related to temperature.
2. State and apply the first two laws of thermodynamics.
3. State and apply the ideal gas equation in solving problems.
4. Perform experiments on heat and thermodynamics and write laboratory reports.

Course Content

Temperature and temperature scales. Thermal expansion of solids. Quantity of heat. Heat transport. Thermal equilibrium and Zeroth law. Heat and Work. First law of Thermodynamics. Thermodynamic processes. Ideal gas laws. Vander Waalls equation of state. Carnot heat engines and refrigerators. Second law of thermodynamics. Entropy.

Mode of Delivery

Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of assessment

C.A.Ts 30%

Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Projector for power point presentation, Laboratory manuals, Laboratory equipment and Apparatus.

Reference Texts

Halliday D. Resnick, R. and Walker J, (2007). Fundamentals of Physics (8th Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Sears F. W., Zemansky M. W. and Young H. D.,(). University Physics, Addison Wesley (any edition).

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

GEOMETRICAL OPTICS

Credit Hours: 3

Pre-requisites: None

Purpose of the course

The purpose of the course is to teach students the basics of geometrical optics i.e. light reflection, refraction and the use of simple optical elements such as mirrors, prisms, lenses, fibers and optical instruments.

Expected learning outcomes

At the end of this course, students should be able to,

1. Describe the rectilinear propagation of light.
2. State and apply the laws of reflection and refraction in solving problems.
3. State and make use of both the mirror and lens equation in solving problems.
4. Perform experiments on Geometrical optics and write laboratory reports.

Course Content

Rectilinear propagation of light. Laws of reflection and refraction. Fermat's principle. Plane surfaces and prisms. Spherical surfaces. Lenses. Spherical mirrors. Lens aberration. Optical equipment (Microscopes, telescopes, prism binoculars, camera and prism spectrometer).

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

Halliday D. Resnick, R. and Walker J, (2007). Fundamentals of Physics (8th Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Sears F. W., Zemansky M. W. and Young H. D.,(). University Physics, Addison Wesley (any edition).

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

INTRODUCTION TO QUANTUM PHYSICS

Credit Hours: 3

Pre-requisites: **None**.

Purpose of the course

The purpose of this course is to introduce students to the basic theories and concepts of quantum physics and discuss experiments that lead to the development of quantum physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. State the failures of the classical theory and describe how these failures were overcomed.
2. Describe wave-particle duality of matter and its applications.
3. Describe the Bohr's atomic models and use it to calculate the various parameters of the atom.
4. Perform experiments on quantum physics and write laboratory reports.

Course Content

Development of modern atomic theory. Failure of classical theories and experimental basis for quantum theory: blackbody radiation, heat capacity, photoelectric effect, Compton effect, etc. Particle-wave duality of matter. De Broglie waves. Uncertainty principle. Structure and properties of atoms. The Bohr model of the atom. Emission and absorption spectra. Radioactivity. X-rays.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

Halliday D. Resnick, R. and Walker J, (2007). Fundamentals of Physics (8th Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Sears F. W., Zemansky M. W. and Young H. D.,(). University Physics, Addison Wesley (any edition).

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

LEVEL TWO

WAVES AND OSCILLATIONS

Credit Hours: 3

Pre-requisites: Year One Physics courses.

Purpose of the course

The purpose of this course is to introduce students to the theory and concepts of waves and oscillations as well as performing experiments in this field of physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Describe periodic motions, forced oscillations and Resonance and apply these concepts in solving problems.
2. Derive the wave equation and use it to calculate the various parameters of a wave.
3. Perform experiments on waves and oscillations and write laboratory reports.

Course Content

Periodic motions. Superposition of periodic motions. The simple harmonic oscillator. Damped harmonic oscillator. Forced oscillations and resonance. Coupled oscillations, normal co-ordinates, degrees of freedom and normal modes of vibration. Transverse waves. The wave equation.Characteristic impedance of waves on a string. Reflection and transmission coefficients. Longitudinal waves. Acoustic phenomena; interference and beats. Standing waves and Eigen frequencies. Acoustic measurements and applications. Doppler effect. Group and phase velocity. Introduction to Fourier analysis.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of assessment

C.A.Ts	30%
Final Exam	70%

Total 100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

Halliday D. Resnick, R.and Walker J (2007). Fundamentals of Physics (8th Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

French A.P. (1971). Vibrations and waves - The M.I.T Introductory Physics Series (1st edition), W. W. Norton & Company; ISBN-10: 0393099369.

Pain H.J (2005). The Physics of Vibrations and Waves (6th Edition).John Wiley & Sons; ISBN: 978-0-470-01296-3.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

INTRODUCTION TO ELECTRICITY AND MAGNETISM

Credit Hours: 3

Pre-requisites: Year one Physics Courses

Purpose of the course

The purpose of this course is to introduce students to the basic concepts of electricity and magnetism. The students will be taught the underlying theories and encouraged to relate them to everyday phenomena.

Expected learning outcomes

At the end of this course, the students should be able to,

1. Describe the fundamental concepts and phenomena in electricity and magnetism.
2. Apply the learnt concepts and laws in solving problems.
3. Perform experiments on electricity and magnetism, take measurements and analyze the obtained data.

Course Content

Electrostatics: electric charge, coulomb's law, electric field, lines of electric force and electric flux. Gauss's law, electric potential and electric potential energy. Capacitors and capacitance, energy storage in capacitors, effect of dielectrics on capacitance. DC circuits; current, resistance, Ohm's law. Kirchhoff's laws, network theorems. Voltage measurement, Potentiometer, Wheatstone bridge. Magnetic field, magnetic flux, force on moving charge in a magnetic field, torque on a current loop, magnetic dipole. Magnetic induction: Faraday's laws of magnetic induction, self and mutual induction. Hysteresis. Energy in magnetic fields.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

David J. Griffiths, (1999). Introduction to electrodynamics. Prentice Hall, Upper Saddle River, New Jersey, ISBN 0-13-805326-X.

Edward M Purcell, (1984). Electricity and Magnetism - Berkeley physics course Vol.2, (2nd edition), McGraw-Hill, **ISBN-10:** 0070049084.

Halliday D. Resnick, R. and Walker J (2007). Fundamentals of Physics (8^{th} Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

QUANTUM MECHANICS

Credit Hours: 3

Pre –requisites: Mechanics, Introduction to Quantum Mechanics, Waves and Oscillations

Purpose of the course

The purpose of this course is to introduce students to the theories and concepts of quantum physics and discuss important experiments encountered in the development of quantum physics.

Expected learning outcomes

At the end of this course, the students should be able to;

1. Identify areas where classical Physics fails and how these failures can be overcome by quantum concepts.
2. Distinguish the similarities and differences between the classical and quantum treatments of the motion of a particle.
3. Recognize the key concepts of quantum physics and be able to apply them in solving problems.

Course Content

Hamiltonian operators. Schrödinger equation. Born's probability density. Potential barriers and tunneling. Square well potential. Harmonic oscillator. Particle in a box and in a sphere. Hydrogen atom and atomic orbitals. Postulates of quantum mechanics. Hermitian operators. Complementarity. Uncertainty principle. Matrix mechanics. Angular momentum operators. Eigen values and eigen functions of angular momentum and spin. Clebsh-Gordon series.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

David J. Griffiths, (2004). Introduction to quantum physics (2nd edition). Benjamin Cummings, ISBN-10: 013111892.

French, A. P, and Edwin F Taylor (1978). Introduction to Quantum Physics. New York, Norton, ISBN: 9780393090154

Gasiorowicz, Stephen. (2003). Quantum Physics (3rd edition). Hoboken NJ Wiley, ISBN: 9780471057000.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

ELECTRICITY AND MAGNETISM

Credit Hours: 3

Pre-requisites: Electricity and Magnetism I.

Purpose of the course

The purpose of this course is to build on what students had been taught in introduction to electricity and Magnetism in order to advance further and enhance concepts in electricity and magnetism. The students are expected to learn more about the underlying theories in electricity and magnetism and be able to relate them to everyday phenomena.

Expected learning outcomes

At the end of this course, the students should be able to,

1. Describe the fundamental concepts and phenomena in electricity and magnetism II.
2. Apply the learnt concepts and laws in solving problems.
3. Perform experiments on electricity and magnetism II, take measurements and analyze the obtained data.

Course Content

Gauss's law and its applications. Electric dipoles. Dielectrics. Modified Gauss's law. Solutions to Laplace's and Poisson's equations. Maxwell's electromagnetic equations. Electromagnetic radiation. A.C. circuits: generation of sinusoidal waveforms, rms value. AC in resistors, capacitors and inductors. Series and parallel LCR circuits. Resonance. Power in AC circuits. AC bridges, impedance and admittance. Filters. Delay lines. Transformers. Transmission lines.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory equipment and Apparatus.

Recommended References

David J. Griffiths, (1999). Introduction to electrodynamics. Prentice Hall, Upper Saddle River, New Jersey, ISBN 0-13-805326-X.

Edward M Purcell, (1984). Electricity and Magnetism - Berkeley physics course Vol.2, (2nd edition), McGraw-Hill, **ISBN-10:** 0070049084.

Halliday D. Resnick, R. and Walker J (2007). Fundamentals of Physics (8^{th} Edition), John Wiley & Sons; ISBN: 978 – 0471758013.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

LEVEL THREE

ATOMIC PHYSICS

Credit Units: 3

Pre-requisites: Introduction to Quantum Physics, Quantum mechanics.

Purpose of the course

The purpose of this course is to introduced students to the main ideas of atomic physics and be taught the basic mathematical methods and techniques used in the fields of atomic physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and explain the central concepts in atomic physics.
2. Solve a range of numerical problems involving atomic physics concepts.

3. Perform experiments based on atomic Physics take measurements and analyze the obtained data.

Course Content

Review of quantum ideas and Bohr's theory of the atom. Somerfield's relativistic model of the atom. Vector model of the atom. Coupling schemes. Normal and anomalous Zeeman effects. Lande g-factor. One -electron spectra. Two - electron spectra. X-ray spectra.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Arthur Beiser, (2002). Concepts of Modern Physics (6^{th} edition). McGraw-Hill, ISBN-10: 0072448482.

French, A. P., and Edwin F. Taylor. (1978). Introduction to Quantum Physics. New York, Norton. ISBN: 9780393090154.

Liboff and Richard L, (2003). Introductory Quantum Mechanics (4th edition). San Francisco, CA: Addison Wesley, ISBN: 9780805387148.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

PROPERTIES OF MATTER

Credit Hours: 3

Pre-requisites: Year two courses.

Purpose of the course

The purpose of the course is to introduce students to the fundamental properties of materials in order to understanding why materials have the properties they do and what can be done to control and improve these properties.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify the characteristics of atoms that determine the physical and mechanical properties of materials.
2. Describe the microstructure that governs many of the properties of a material.
3. Solve a range of numerical problems involving the learnt concepts.
4. Perform experiments based on properties of matter, analyze experimental data and write laboratory report.

Course Content

Molecules and bonding, inter-atomic forces, states of matter, crystalline and amorphous structures, liquids and liquid crystals,. Gases (ideal and nearly ideal), inter-atomic potentials, kinetic theory, Maxwell's distribution, rms speed and gas pressure, gas laws, equation of state, specific heat, thermal conductivity. Crystal structures: symmetry, Bravais Lattice. Radial distribution functions. X-ray diffraction. Miller indices. Cohesion of ionic crystals, Madelung's constant. Surface tension and surface energy of liquids. Application to convex surfaces, capillarity and suction. Viscosity: Poiselli's formula, Stoke's method. Laminar flow and Bernoulli's equation. Elastic properties of solids. Static flow properties of fluids.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Charles Kettel, (2004). Introduction to solid state Physics (8th edition), Wiley, ISBN-10: 047141526X.

Michael de Podesta, (2002). Understanding properties of matter (2nd Edition), CRC Press, ISBN-10: 0415257883.

Neil W Ashcroft, (1976). Solid state Physics (1st edition), Brooks Cole, ISBN-10: 0030839939.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

PHYSICAL OPTICS.

Credit Hours: 3

Pre-requisite: Geometrical Optics, Waves and Oscillations

Purpose of the course

The purpose of this course is to provide students with knowledge of the fundamental concepts in Physical optics and discuss experiments encountered in this area of Physics.

Expected learning Outcomes

At the end of this course, students should be able to:

1. Identify and describe the fundamental concepts in Physical optics.
2. Solve a range of numerical problems involving the learnt concepts in physical optics.
3. Perform experiments based on Physical optics, analyze experimental data and write laboratory report.

Course Content

Theory of interference. Fresnel and Franhouffer diffraction. Zone plate. Diffraction at straight edge and at a number of parallel slits. Resolving power of optical instruments. Fresnel's explanation of optical activity. Polarimeters.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Eugene Hecht, (2001). Optics (4th edition), Addison Wesley, ISBN-10: 0805385665.

Pedrotti F.L, Pedrotti L.S and Pedrotti L.M, (2007). Introduction to Optics (3rd Edition), Pearson Prentice-Hall, ISBN: 0134914651.

Robert H. Webb (1997). Elementary Wave Optics, Dover Publications, ISBN13**:** 9780486439358.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

ELECTRONICS

Credit Hours: 3

Pre-requisites: **Electricity and magnetism**

Purpose of the course

The purpose of this course is to provide students with the fundamentals of Electronics. The students will be introduced to the main ideas of electronics and be taught the basic mathematical methods and techniques used in this fields.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and describe the fundamental concepts in electronics.
2. Solve a range of numerical problems involving the learnt concepts in electronics.

3. Perform experiments based on electronics, analyze experimental data and write laboratory report.

Course Content

Introduction to semiconductor physics. Energy bands, electrons and holes. The P-N junction biasing. Semi conductor diode. Rectifiers. Junction transistors (characteristics and operations). Manufacture of grown junctions, fused junctions and point contact diode. Field effect transistors. MOSFET. Transistor amplifiers, types of amplifier circuits. Current and Voltage amplifiers. Feedback. Oscillators. Linear integrated circuits. Operational amplifiers and its applications.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Albert Malvino, (1998). Electronic Principles (6th edition), Career Education, 1998, **ISBN-10:** 0028028333.

Benerd Grob (1997), Basic electronics (8th edition), McGraw-Hill, ISBN-10: 002802253X.

Theraja B.L, (2007). Basic Electronics Solid state (5th edition), S Chand & Co Ltd, ISBN-10: 8121925568.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

LEVEL FOUR

NUCLEAR PHYSICS

Credit Hours: 3

Pre-requisites: Introduction to Quantum Physics, Atomic physics and Quantum mechanics.

Purpose of the course

The purpose of this course is to equip students with the theoretical and experimental Nuclear physics concepts. The students will be introduced to the main ideas of Nuclear physics and be taught the basic mathematical methods and techniques used in the fields of Nuclear physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and describe the fundamental concepts learnt in Nuclear Physics.
2. Solve a range of numerical problems involving the learnt concepts in Nuclear Physics.
3. Perform experiments based on Nuclear Physics, analyze experimental data and write laboratory report.

Course Content

Atomic nucleus, systematics of stable nuclei. Natural and artificial radioactivity. Nuclear detectors. Nuclear models (shell and liquid-drop). Mass and isotropic abundance of nuclei. Nuclear stability. Nuclear forces. Neutron sources, slow down chain reacting pile and their interaction. Nuclear fission and power reactors. Nuclear fusion. Radiation monitoring and safety measures. Applications of nuclear Physics. Isotopes and applications in medicine, agriculture and industry.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Kenneth S. Krane. (1987). Introductory nuclear Physics (3rd edition), John Wiley & Sons, ISBN-10: 047180553X.

Shultis J.K and Faw R.E, (2007). Fundamentals of Nuclear science and engineering (2nd Edition), CRC Press, ISBN-10: 1420051350.

Tayal D.G, (1992). Nuclear Physics, Himalaya Publishing House, ISBN: 81-7040-751-6.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

SOLID STATE PHYSICS

Credit Hours: 3

Pre-requisites: Properties of matter

Purpose of the course

The purpose of this course is to equip students with the theoretical and experimental Solid state physics concepts. The students will be introduced to the fundamental ideas of Solid state physics and be taught the basic mathematical methods and techniques used in the fields of Solid state physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and describe the fundamental concepts learnt in Solid state physics.
2. Solve a range of numerical problems involving the learnt concepts in Solid State Physics.
3. Perform experiments based on Solid State Physics, analyze experimental data and write laboratory report.

Course Content

Review of atomic bonding, crystallinity and forms of solids. Brillouin zones. Lattice dynamics: Elastic waves and phonons, Phonon statistics, Vibrational modes and spectrum. Specific heat (lattice and electronic). Band structures. Electron-phonon interaction. Impurity states and nature of lattice defects. Characteristic properties of dielectrics, metals, semiconductors and magnetic solids. Cooperative phenomena. Superconductivity. Mode of electronic transport in solids. Ferro –, para- and diamagnetics. Applications to solid state devices. Electro-optics and lasers.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Blakemore J.S, (19850). Solid state Physics (2nd edition), Cambridge University Press, ISBN10: 0521313910.

Charles Kettel, (2004). Introduction to solid state Physics (8th edition), Wiley, ISBN-10: 047141526X.

Neil W Ashcroft, (1976). Solid state Physics (1st edition), Brooks Cole; 1976, ISBN-10: 0030839939.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

ELECTROMAGNETIC THEORY

Credit Hours: 3

Prerequisites: **Electricity and Magnetism I &II.**

Purpose of the course

The purpose of this course is to equip student with the theoretical and experimental electromagnetic theory concepts. The students will be introduced to the main ideas of electromagnetic theory and be taught the basic mathematical methods and techniques used in the fields of electromagnetic theory.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and describe the fundamental concepts learnt in electromagnetic theory.
2. Solve a range of numerical problems involving the learnt concepts in Electromagnetic theory.
3. Perform experiments based on Electromagnetic theory, analyze experimental data and write laboratory report.

Course Content

Magnetic fields in matter: Magnetization, magnetic intensity, magnets. Electromagnetic waves. Maxwell's equations. Plane waves in isotropic dielectrics and conducting media. Reflection and refraction of plane waves at dielectric and metallic boundaries. Polarization. Wave guides. EM radiation: scattering and dispersion. Electromagnetism

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

David J. Griffiths (1999). Introduction to electrodynamics. Prentice Hall, Upper Saddle River, New Jersey, ISBN 0-13-805326-X.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

ENVIRONMENTAL AND RENEWABLE ENERGY PHYSICS

Credit Hours: 3

Pre – requisites: Heat and thermodynamics, Introduction to Quantum Physics and Physical optics.

Purpose of the course

The purpose of this course is to equip the student with the fundamental concepts of Environmental and renewable physics.

Expected learning outcomes

At the end of this course, students should be able to,

1. Identify and describe the fundamental concepts learnt in Environmental and renewable energy Physics.
2. Solve a range of numerical problems involving the learnt concepts in Environmental and renewable energy Physics.
3. Perform experiments based on Environmental and renewable energy Physics, analyze experimental data and write laboratory report.

Course Content

The concept of energy. Global energy supply and consumption patterns. Energy conservation practices. World energy sources: fossil fuels, nuclear, solar, geothermal, wind, water. Ocean thermal gradient. Tides. Biomass and wood fuel. The global environment. Physics of atmospheric processes (eg. Solar terrestrial radiation). Transport processes in atmosphere. Water, air, energy balance and hydrological cycle. Water vapour. Heat exchange. Heat conduction in soils, pollution problems. Applications of physics to medical, biological and environmental.

Mode of Delivery

The course will be delivered through Lectures, Tutorials, Practical demonstrations and Hands on Laboratory sessions.

Mode of Assessment

C.A.Ts	30%
Final Exam	70%
Total	100%

Instructional Material and/or Equipment

Chalk and Chalkboard, Laboratory manuals, Laboratory Equipment and Apparatus.

Recommended References

Bent Sorensen, (2010). Renewable Energy; Engineering, Environmental Impacts, Economics & planning, Academic Press; 4th edition, 2010, ISBN-10: 0123750253.

Relevant Website;

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html.

5.7 GEOGRAPHY

Rationale

Geography as a discipline describes and analyses the location of places on the earth and the spatial distribution of phenomena in their varied interrelationships as they influence human activities. The discipline is dynamic as it responds to the ever changing environmental challenges. The discipline therefore transcends boundaries of other disciplines in an attempt to describe the earth and its diverse components. As such the discipline interrelates very well with other subjects. The discipline therefore belongs to both the arts and the sciences. Geography plays a role in nearly every decision we make. Choosing sites, targeting market segments, planning distribution networks, responding to emergencies, or redrawing country boundaries- all of these problems involve questions of geography.

The programme exposes the students to a systematic study of both physical and human aspects of geography. The programme has tried to give special emphasis to practical geography thus providing the student with the opportunity to learn how to manage and conserve our natural resources. The content is developed from basic geographical concepts to the more complex ones taking cognizance of the psychological development of the learner. After completion of the programme, the graduates can be employed in a wide range of professions such as mappers of resources for development, cartographers, planners, demographers, conservationists, etc.

Geography graduates have found jobs with international organisations such as United Nations Environment Programme (UNEP), UN- Habitat, United Nations Development Programme (UNDP), World Meteorological Organisation (WMO), National Aeronautics and Space Administration (NASA), Consultative Group in International Agricultural Research (CGIAR) centres, Inter-Governmental Authority on Development (IGAD), etc. Transport Geographers

have found jobs with the World Health Organisation (WHO) where they work alongside the epidemiologists, while Agricultural Geographers have found jobs with FAO, IFAD among other Agricultural organisations. Geographers also work with International Organisations and NGOs involved in combating desertification and climate change.

There has been a high turnover of Geography teachers in our Secondary schools, where they leave the profession for greener pastures. Taking cognisance of this, we need to keep training Geography teachers to replace those who leave the profession.

Purpose of the course of the Course

This Geography degree programme, aims to prepare graduates who can be of service in a wide range of professions such as teaching, planning, doing research, mapping resources for development, policy making as well as being of service to the other sectors of the economy. The programme provides opportunities to learn the big issue that affect our lives. Questions of access to drinking water, globalization, climate change, rising levels of resource consumption, inequality, environmental degradation etc, can all be addressed through geographical knowledge. Geography is uniquely placed to deal with the exponential growth of spatially referenced information (post codes, digital map data and photograph data) and continues to be important in the areas of remote sensing and Geographical information systems (GIS).

Programme learning outcomes

By the end of the programme students will be able to:

1) Acquire the necessary skills in planning, mapping of resources, conserving of resources.

2) Acquire skills and knowledge that will help them become global citizens.

3) Gain insights into the importance of Geography.

4) Acquire proper attitudes to recognize different types of environments and manage them for individual, national and international development.

5) Appreciate weather phenomena and their influence on the physical environment and human activities.

6) Gain the necessary knowledge to enable them explain the land forming processes and the resultant features and their influence on human activities.

7) Acquire knowledge on the available natural resources and demonstrate ability and willingness to utilize them sustainably

8) Get the necessary skills and knowledge to interpret, analyze and use geographical principles and methods to solve problems of national and international development

9) Get the necessary knowledge, skills and attitudes to fit in the competitive global job market.

Level 100 Courses

COURSE	CREDIT HOURS
Introduction to Geography	3
Environmental Geography	3
Cartography and Map Analysis	3
Physical Geography I	3

Level 200 Courses

COURSE	CREDIT HOURS
Human Geography I	3
Geography of East Africa	3
Physical Geography II	3
Human Geography II	3

Level 300 Courses

COURSE	CREDIT HOURS
Air Photo Interpretation and Research Methods in Geography	3
Remote Sensing and Resource Management	3
Geographical Information Systems (GIS)	3
Senior Project	3

Level 400 Courses

COURSE	CREDIT HOURS
Quantitative Techniques and Computer Aided Data Analysis	3
Climatology	3
Geography of Tourism & Recreation	3
Agricultural Geography	3

INTRODUCTION TO GEOGRAPHY **3 CREDIT HOURS**

Purpose of the course

The course introduces students to some fundamental concepts in the development of geography. It briefly traces the evolution of the discipline geography focusing on the various changes in the content and methodology of geography. It also endeavours to examine the fundamental aspects of geography from a global perspective. The course attempts to make the students world citizens by making them understand the physical and human environments of the world.

Expected learning Outcomes

By the end of the course students should be able to:

1. Define the concept geography emphasizing its main dimensions of concern
2. Explain the changes in the content and methodology of geography
3. Discuss the various paradigms that have influenced the content and methodology of geography
4. Describe the global geography in particular the salient physical and human features of the world
5. Examine and assess the role of geographers in national development

Course Content

Definition and concerns of geography as a discipline. Changes in the content and methodology of geography. Geography through pre-history, ancient times, middle ages, renaissance, classical, post-classical and modern times. Geography as a paradigmatic discipline. Global geography: major physical and human features of the earth; their distribution and spatial location. Distinguishing features of developed and developing countries. Role of geographers in national and international development.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reading materials

Required textbook

1) Bergman, E.F. and Renwick, W. H. (2010). *Introduction to Geography.* New Jersey: Pearson Education.

Further Reading

1) Bergman, E.F. and Renwick, W. H. (2008). *Introduction to Geography: People, Places and Environment.* London: Prentice Hall.

2) Getis, A. Getis, J. and Fellmann, J. D. (2007). *Introduction to Geography*. London: McGraw-Hill.

Relevant websites

http://www.nationalgeographic.com/geography-action/

http://wps.prenhall.com/esm_bergman_introgeo_3/

ENVIRONMENTAL GEOGRAPHY **3 CREDIT HOURS**

Purpose of the course

This course introduces students to the study of the environment. It lays emphasis on the application of geographical information to the solution of environmental problems. The course serves as a bridge between physical and human branches of geography.

Expected learning Outcomes

By the end of the course, the students should be able to:

1. Explain the principles of environmental conservation and management
2. Apply the knowledge and skills in conserving the environment
3. Identify, analyze, and assess environmental problems and develop appropriate methods of solving them
4. Explain the importance of a healthy environment
5. Examine and offer solutions to the salient global environmental problems

Course Content

Concept of the environment. Resources and ecosystems. Environmental issues in Kenya. Kenya's constitutional and legislative frameworks on the environment. Environmental sustainability and sustainable development. Global environmental issues. Environmental pollution and externalities. Conservation and management of environmental resources. Emerging environmental issues. National and international policy issues on the environment.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Required textbook

1) Singh, L. (2010). *Environmental Geography***.** New Delhi: APH publishing Corporation.

Further Reading

1) Castree, N., Demeritt, D. and Liverman, D. (2009). *A Companion to Environmental Geography*. Sussex: Wiley-Blackwell.

2) Carpenter, D.O. (2009). *Environmental challenges in the Pacific Basin*. New York: State Department of Health, USA.

3) Berry, R. J. (2006). *Environmental stewardship: critical perspectives, past and present*. London: **T & T Clark.**

4) Bradley, I. C. (1990). *God Is Green: Christianity and the Environment*. London: Darton, Longman & Todd.

Relevant websites

careofcreation.org ("mobilizing the church to care for Creation...")

www.GenerousGiving.org *(*Biblical perspectives on generosity and stewardship**)**

alanmarshall.org/essays (Christians and the Environment: A Study Guide)

CARTOGRAPHY AND MAP ANALYSIS 3 CREDIT HOURS

Purpose of the course

This course provides students with skills of reading, interpreting and analyzing maps. It also equips students with cartographic skills among other methods of handling geographical data.

Expected learning Outcomes

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

1. Read, interpret and analyze maps
2. Use cartographic equipment to draw maps
3. Identify and differentiate types of maps.
4. Use the computer to do some cartographic work in addition to manual cartography
5. Analyze relief and slopes, drainage basins, settlements, networks and land use.
6. Assess and examine the importance of maps.

Course Content

Introduction to maps and cartography; history of cartography; use and care of drawing instruments; free hand lettering; map scales; conventional signs used in maps; map orientation; map legend; map design and compilation; map revision; map interpretation; thematic maps; chorochromatic and dot maps; measurements of distance and area. The course will introduce

students to the use of computers in cartographic work in addition to manual cartography. The course will also include relief and slope analysis, drainage basin analysis; settlement analysis – types of settlements, nearest neighbour index, network and land-use analysis.

Mode of Delivery

Lectures, class discussions, practical exercises, Field trips, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries, relevant softwares such as arc info, arc GIS etc

Recommended Reference Materials

Required textbook

1) Kraak**, M. and** *Ormeling***, F. (2009).** *Cartography***: Visualization of Spatial Data. London: Prentice Hall.**

Further Reading

1) Slocum, T. A., McMaster, R. B., Kessler, F. C. and Howard, H. H. (2009). *Thematic Cartography and Geovisualization*. London**:** Prentice Hall.
2) **Peterson, G. N. (2009*). GIS cartography: a guide to effective map design*. Boca Raton, FL: CRC Press.**

Relevant websites

http://gispathway.com/

http://www.cartotalk.com/

PHYSICAL GEOGRAPHY I **3 CREDIT HOURS**

Purpose of the course

The course provides the students with an introduction to the geographical aspects of the physical environment as it affects society's livelihoods. It also provides the students with a highlight of the society's impact on the physical environment particularly the lithosphere, atmosphere, hydrosphere and biosphere.

Expected learning Outcomes

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

1. Explain the origin of the earth and the entire solar system.
2. Describe the internal structure of the earth
3. Explain the relationship between the earth's internal structure and endogenic processes that influence the origin and formation of landforms as well as materials on the earth's surface.
4. Describe and explain the composition, structure and processes of the atmosphere.
5. Describe, explain and analyze the components of the biosphere.

Course Content

Introduction to the nature and scope of physical Geography, the components of Physical Geography and interactions amongst themselves and society, the origin of the earth and entire solar system/universe, internal structure of the earth, plate tectonics and continental drift, introduction to endogenic processes and materials on the earth's surface, the atmosphere, its composition, structure, processes and circulations, weather, climate and factors influencing climate, the biosphere; its nature and components, biotic and abiotic factors, the ecosystem and

its structure, energy flow and nutrient cycling. Field work on landforms associated with endogenic processes and writing of a report.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, Lads, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Hess, D. and Tasa, D. (2010). *McKnight's Physical Geography, A Landscape Appreciation: International Edition.* New Jersey: Pearson Education.

Further Reading

1) Holden, J. (2008). *An Introduction to Physical Geography and the Environment 2nd Edition.* New Jersey: Pearson Education.

2) Christopherson, R. and Thomsen, C. (2008). *Applied Physical Geography Geosystems in the Laboratory 7th Edition*. New Jersey: Pearson Education.

Relevant websites

http://www.physicalgeography.net/fundamentals/contents.html

http://wps.prenhall.com/esm_mcknight_physgeo_8/

HUMAN GEOGRAPHY 1 **3 CREDIT HOURS**

Purpose of the course

The course helps the learner to examine the interaction between human beings and the environment by introducing some theories that simplify the complex nature of human activities. It emphasizes agricultural, industrial and settlement theories. Human geography concepts that show how human activities are inter-related are also elucidated.

Expected learning Outcomes

By the end of the course students should be able to:

1. Explain the scientific nature of human geography
2. Discuss the content and methodology of Human Geography
3. Examine the philosophical underpinnings of human geography that make it a scientific discipline.
4. Assess the relevance of classical location theory in the contemporary world
5. Explain the bases for spatial interaction

Course Content

Scientific revolutions and evolution of academic disciplines. Scientific nature of human geography. Content and methodology of human geography. Philosophical underpinnings of human geography. Basic economic concepts. Classical location theory (von Thunen's agricultural location theory; Weber's industrial location theory and Christaller's Central place theory). Spatial patterns of urban land use. Bases for spatial interaction: gravity models and diffusion models.

Teaching Methodologies

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Swanson, K. (2010). *Kaplan AP Human Geography 2009 Edition.* New York: Kaplan Publishing.

Further Reading

1) Rubenstein, J. (2010). *The Cultural Landscape, An Introduction to Human Geography: International Edition 10th Edition* New Jersey: Pearson Education.

2) Daniels, P., Bradshaw, M., Shaw, D. and Sidaway, J. (2008). *An Introduction to Human Geography: Issues for the 21st Century.* New Jersey: Pearson Education.

Relevant websites

http://wps.prenhall.com/esm_rubenstein_humangeo_8/

http://en.wikipedia.org/wiki/Human_geography

GEOGRAPHY OF EAST AFRICA 3 CREDIT HOURS

Purpose of the course

The course examines the physical and human environments in East Africa. It also looks at the constraints to resource utilization in East Africa. The course equips students with knowledge and skills to enable them teach the geography of East Africa. The course uses both topical (thematic) and regional approaches to help students understand the inter-relatedness of geographical phenomena.

Expected learning Outcomes

By the end of the course students should be able to:

1. Describe the East African physical environment emphasizing geomorphology, hydrology, climatology and biogeography
2. Explain the formation and significance of the East African Rift Valley system
3. Explain and offer solutions to problems of aridity and desertification in East Africa
4. Describe the various constraints to resource exploitation in East Africa.
5. Examine the various problems of development in East Africa

Course Content

The physical environment of East Africa, Relief, geology, drainage and climate of East African. The East African Rift System. Vegetation, soils, animal and insect life in East Africa. Problems of environmental degradation in East Africa. East Africa human environment. Language groups of the peoples of East Africa, population distribution and dynamics, agricultural, pastoral, traditional and modern land use systems, manufacturing, mining, energy, tourism and recreation, transport and urbanization in East Africa.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers. Field work trips to places such as the Rift valley, the Lake Victoria basin etc. will also be undertaken.

Course Assessment

Type	**Weighting**

Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Required textbook

1) Lucas, C. P. (2009). ***Geography of South and East Africa.*** **New Delhi:** General Books.

Further Reading

1) Aryeetey-Attoh, S. McDade, B. E., Obia, G. C., Oppong, J. R., Osei, W. Y., Yeboah, Johnston-Anumonwo, I. (2009). *Geography of Sub-Saharan Africa.* New York: Prentice Hall.

2) Moss, T. J. (2007). *African Development: Making sense of the issues and actors.* New York: Lynne Rienner Publishers.

Relevant websites

http://en.wikipedia.org/wiki/East_Africa

www.**african**culturalcenter.org/1_4**east**.html

PHYSICAL GEOGRAPHY II **3 CREDIT HOURS**

Purpose of the course

The course helps the student to further understand details of the hydrosphere and the lithosphere showing the complex interrelationships between them.

Expected learning Outcomes

By the end of the course, the student should be able to:

1. Describe the hydrological cycle and show how human beings have affected its components.
2. Explain the global distribution of water resources in different forms; underground, surface, vapour and even ice/glacier.
3. Explain the components and usefulness of the water balance equation(s)
4. Examine water use in vegetations
5. Describe and analyze geomorphologic processes; erosion, weathering and mass movement on the landscape.

Course Content

World hydrological cycle, global water distribution, the water balance and its components, precipitation, evaporation, stream flows, ground water – capacity, aquifers, recharge and discharge of aquifers, potential and limitations of groundwater and vegetation water needs. Introduction to geomorphologic processes – Fluvial and Aeolian processes and resulting landforms, the cycle of erosion, slopes and associated processes, weathering and its impact on landscape and land use, the work of waves in coastal areas in terms of erosion, deposition and impact on land use.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, field work, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Hess, D. and Tasa, D. (2010). *McKnight's Physical Geography, A Landscape Appreciation: International Edition.* New Jersey: Pearson Education.

Further Reading

1) Holden, J. (2008). *An Introduction to Physical Geography and the Environment*. New Jersey: Pearson Education.

2) Christopherson, R. and Thomsen, C. (2008). *Applied Physical Geography: Geosystems in the Laboratory*. New Jersey: Pearson Education.

Relevant websites

http://www.physicalgeography.net/fundamentals/contents.html

http://wps.prenhall.com/esm_mcknight_physgeo_8/

HUMAN GEOGRAPHY II **3 CREDIT HOURS**

Purpose of the course

This course helps the student understand the importance of decision making in changing the face of the earth. The course shows that human beings are very instrumental in shaping the face of the earth. Human beings are portrayed as capable of shaping and managing their destiny and that of the entire globe.

Expected learning Outcomes

By the end of the course students should be able to:

1. Analyze land use theory and assess its importance

2. Distinguish between rural and urban land uses
3. Explain the processes of decision making
4. Discuss human interactions both at the macro- and micro-levels
5. Examine networks of communication and assess their role in national development.

Course Content

Land use theory (rural and urban land use theories), land use and decision making, spatial interaction models, macro and micro patterns of spatial interaction, structure and properties of networks, evolution of transport networks, industries and urban centres as nodes, location of service centres. Regularity of nodes. Processes of decision making. Migration and the gravity models.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Required textbook

1) Swanson, K. (2010). *Kaplan AP Human Geography 2009 Edition.* New York: Kaplan Publishing.

Further Reading

1) Rubenstein, J. (2010). *The Cultural Landscape, An Introduction to Human Geography: International Edition.* New Jersey: Pearson Education.

2) Daniels, P., Bradshaw, M., Shaw, D. and Sidaway, J. (2008). *An Introduction to Human Geography: Issues for the 21st Century, 3rd Edition.* New Jersey: Pearson Education.

Relevant websites

http://wps.prenhall.com/esm_rubenstein_humangeo_8/

http://en.wikipedia.org/wiki/Human_geography

AIR PHOTO INTERPRETATION & RESEARCH METHODS IN GEOGRAPHY
3 CREDIT HOURS

Purpose of the course

The course helps the student to understand Aerial photography as an important source of data for Geographical Analysis. Students are introduced to aerial photography and techniques of interpreting data acquired through aerial photographs.

Expected learning Outcomes

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

1. Define aerial photography and explain its role in Geographical Analysis
2. Explain the types and history of aerial photography
3. Describe how aerial photographs are acquired.
4. Explain the procedures of carrying out aerial interpretation.
5. Use a stereoscope.
6. Interpret aerial photographs using stereoscopes

Course Content

Introduction to aerial photography, role of aerial photographs, types of aerial photographs, history of aerial photography, acquiring aerial photographs, scale of photographs, technical aspects of aerial photographs – electromagnetic energy, electromagnetic spectrum, types of films, the aerial cameras, interpretation of aerial photographs – marginal information, stereoscopes and stereoscopic viewing; methods of air photo-interpretation – general examination, methods of identifying features and objects on photographs. Practical role of aerial photography in landform identification, land use analysis, crop types, vegetation types and urban land use among others. Definition of a Geographical research problem and the procedures used to carry out the research.

Teaching Methodologies

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, field work, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries, GPS and digital cameras.

Recommended Reference Materials

Required textbooks

1) Avery, T. E. and Berlin, G. L. L. (1992). *Fundamentals of Remote Sensing and Airphoto Interpretation.* New York: Prentice Hall.

2) Montello, D. and Sutton, P. (2006). *An Introduction to Scientific Research Methods in Geography*. London: Sage Publications.

Further Reading

1) Kothari, C. R. (2008). *Research Methodology: Methods and Techniques* New Delhi: New Age International (P) Limited Publishers.

2) Nachmias, C. F. and Nachmias, D. (2008). *Research Methods in the Social Sciences* London: Hodder Education.

Relevant websites

http://www.vho.org/GB/Books/dth/fndaerial.html

en.wikipedia.org/wiki/Aerial_photography

REMOTE SENSING AND RESOURCE MANAGEMENT 3 CREDIT HOURS

Purpose of the course

The course equips students with Remote sensing skills, an important space technology used to acquire information about the status of the earth and its resources. The course enables students to map resources for development.

Expected learning Outcomes

By the end of the reason of the course the student should be able to:

1. Define remote sensing and assess its use in resource mapping and management.
2. Describe and analyze methods of satellite image interpretation and data analysis
3. Explain how remote sensing technology can be applied in agriculture, forestry, wildlife and range management, hydrology, meteorology among other areas.
4. Critique the effectiveness of remote sensing in national development

Course Content

Introduction to remote sensing and its history, remote sensing concepts and terminology, types of satellites, sensors and platforms. Physical basis of remote sensing, sensor systems – passive and active, processes of acquiring remote sensed image.

Pattern recognition and image interpretation, composite colour images, multi spectral colour images, numerical analysis of remote sensed data – supervised and unsupervised classification; application of remote sensing in agricultural, forest, geological, meteorology, rangeland and hydrological surveys. Limitations of remote sensing technology in developing countries such as Kenya.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers. Field visits to places such as Department of Resource surveys and Remote Sensing (DRSRS) and Regional Centre for mapping of Resources for Development (RCMRD).

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Required textbook

1) Kumar, B. A. (2007). *Remote Sensing and GIS for Natural Resource Management.* New Delhi: Eastern Book Corporation.

Further Reading

1) Price, M. (2008). *Mastering Arc GIS.* Toronto: McGraw-Hill Higher Education.

2) Lillesand, T., Kiefer, R. W. and Chipman, J. (2007). *Remote Sensing and Image Interpretation.* New York: John Wiley & Sons.

Relevant websites

http://staff.aub.edu.lb/~webeco/rs%20lectures.htm

http://www.gisdevelopment.net/application/nrm/overview/nrm0006.htm

en.wikipedia.org/wiki/*Remote_sensing*

en.wikipedia.org/wiki/*Resource_management*

GEOGRAPHICAL INFORMATION SYSTEMS (GIS) 3 CREDIT HOURS

Purpose of the course

With the advances in ICT, this course aims at equipping the students with skills and knowledge of GIS to enable them solve problems of resource use and development. The students will use appropriate sets of hardware and software to deal with problems having a spatial dimension. GIS is a very important tool for any modern geographer.

Expected learning outcomes

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

1. Explain the role of GIS in the analysis of spatial data.
2. Identify the necessary hardware, software and lifeware required in the installation of an operational GIS work station.
3. Explain the principles of GIS
4. Apply GIS in mapping of resources for development
5. Assess the limitations of using GIS.
6. Use GIS softwares to map resources.

Course Content

Introduction to GIS and its role, Use of modern technology in spatial data analysis, introduction to basic computer concepts, general operating system, GIS hardware, GIS software and lifeware, GIS application areas, institutions using GIS in Kenya. Limitations of GIS technology.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Price, M. (2008). *Mastering ArcGIS*, Toronto: McGraw Hill Higher Education.

Further Reading

1) Chang, Kang-Tsung. (2008). *Introduction to Geographic information systems*, Toronto: McGraw-Hill.

2) Heywood, I., Cornelius, S. and Carver, S. (2006). *An Introduction to Geographical Information Systems*. London: Amazon Books

Relevant websites

en.wikipedia.org/wiki/GIS

http://staff.aub.edu.lb/~webeco/rs%20lectures.htm

http://www.gisdevelopment.net/application/nrm/overview/nrm0006.htm

SENIOR RESEARCH PROJECT 3 CREDIT HOURS

Purpose of the course

This course equips students with skills and knowledge of doing Geographical research and writing a research project.

Expected learning outcomes

By the end of the course students should be able to:

1. Analyze the major chapters in proposal and project (thesis) writing.
2. Examine the importance of literature review
3. Evaluate the various methods of data collection and analyses.
4. Analyze problems encountered during data analyses and interpretation.
5. Describe ways of summarizing, concluding and giving recommendations in a research project.
6. Write good project proposals and thesis.

Course Content

Definition of research; chapters in proposal and thesis writing; research variables; types of research, components of a good research project; Research design and methodology, Literature review, Data analysis and presentation. Writing of a research project.

Mode of Delivery

Lectures, class, discussions, Literature review, class presentation, buzz groups, fieldwork, seminar presentations.

Course Assessment

Type	**Weighting**
Proposal Writing	30%
Seminar Presentations	10%
Final Research Project	60%

Instructional Materials

Chalkboard, flip charts, class handouts (Past projects) Powerpoint presentations,

Transparencies, DVDs, LCDs, CDs, documentaries, Relevant softwares.

Recommended Reference Materials

Required textbook

1) Wickham, S. and Hodgkinson-Williams, C. (2008). *Research Design Toolkit*. University of Cape Town: Centre of Educational Technology.

Further Reading

1) Booth, W. C, Colomb, G. G. and Williams, J. M. (2008). *The Craft of Research***.** Chicago: University of Chicago Press.

2) Nachmias, C. F. and Nachamias, D. (2008). *Research Methods in the Social Sciences.* London: St. Martins press.

3) Cohen, L,. Manion, L. and Morrison, K. (2007). *Research Methods in Education*. London: Routledge.

Web sites

http://www.crlsresearchguide.org/17_Writing_Introduction.asp

http://www.idrc.ca/en/ev-57070-201-1-DO_TOPIC.html

QUANTITATIVE TECHNIQUES AND COMPUTER AIDED DATA ANALYSIS
3 CREDIT HOURS

Purpose of the course

The course introduces students to statistical skills and techniques of handling and analysing geographical data. The use of relevant statistical soft wares in analysing geographical data is emphasized.

Expected learning Outcomes

At the end of the course, students should be able to:

1. Perform basic statistical analysis such as: frequency distribution measurement of central tendency and dispersion and inferential statistics.
2. Apply these skills in studying geographical phenomena.
3. Use computer softwares such as SPSS, Excel, Microfit, stata, etc to analyze geographical data.
4. Analyze geographical information using GIS soft wares such as arc info, arc GIS etc

Course Content

Measures of central tendency and dispersion; introduction to inferential statistics; probability theory and distributions; sampling techniques, the formulation and testing of simple hypothesis through the application of descriptive statistics.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries, computer soft wares such as SPSS, Excel, SAS, stata, microfit etc.

Recommended Reference Materials

Required textbook

1) Burt, J. E. and Barber, G. M. (2009). *Elementary Statistics for Geographers.* London: Guilford Press.

Further Reading

1) Bartholomew, D. J. (2008). *Analysis of Multivariate Social Science Data*: London: London University Press.

2) Rogerson, P. A. (2006). *Statistical Methods for Geography: A Student's Guide.* London: Sage Publications Ltd.

3) Afifi, A. (2003). *Computer-Aided Multivariate Analysis*. Los Angeles: University of California Press.

Relevant websites

http://en.wikipedia.org/wiki/Quantitative_revolution

http://www.sou.edu/GEOGRAPHY/JONES/GEOG386/lectures/lectures.htm

CLIMATOLOGY **3 CREDIT HOURS**

Purpose of the course

This course is meant to broaden students' understanding of the principle components of Physical Geography specifically the atmosphere. The course helps the learners to understand the impact of climate change on the physical and human environments.

Expected learning Outcomes

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

1. Explain the scope of climatology
2. Explain the relationship between climatology and other related sciences such as meteorology
3. State and explain the modern branches of climatology
4. Analyze the different climatic classification schemes
5. Assess the impact of climate change on global resources and human activities.

Course Content

Scope and development of climatology, climatic variables and their measurements; Analysis of climatic data; Climatic classification schemes; Global climates both in the tropics, subtropics and temperate regions, climatic variability and climate change and their effects on water resources, agriculture and other human activities.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	Weighting
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Robert, R., Vega A. J. (2008). *Climatology*. London: Jones and Bartlett Publishers International.

Further Readings

1) Aguado, E. and Burt, J. (2009). *Understanding Weather and Climate*. New Jersey: Pearson Education.

2) Bonan, G. B. (2008). Ecological Climatology: Concepts and Applications.Cambridge: Cambridge University Press.

Relevant websites

http://en.wikipedia.org/wiki/Climatology

http://anhonestclimatedebate.wordpress.com/2008/09/28/the-ten-commandments-of-the-cult-of-climatology/

http://www.wisegeek.com/what-is-climatology.htm

GEOGRAPHY OF TOURISM AND RECREATION 3 CREDIT HOURS

Purpose of the course

This course looks at tourism and recreation from a geographical perspective emphasizing the tourism and recreation resources available in Kenya and other countries. It also looks at environmental, cultural and other factors that influence the development of tourism. The course also examines the impacts of tourism on the various sectors of the economy.

Expected learning Outcomes

By the end of the course students should be able to:

1) Identify and analyze the tourism and recreational resources available in selected countries of the world
2) Explain the factors that influence the development of tourism
3) Assess the significance of tourism
4) Analyze and resolve the conflicts between tourism and other economic activities
5) Examine the policy issues affecting tourism development

Course Content

Tourism and recreational activities and resources, factors influencing tourism, ecotourism, tourism and recreational sites in East Africa and Switzerland, significance of tourism, conflicts and conflict resolution in the tourism and recreational sector, policy issues in tourism.

Mode of Delivery

Lectures, class discussions, practical exercises, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%

Final examination 70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.

Recommended Reference Materials

Required textbook

1) Telfer**, D. J. and** Sharpley, R. **(2007).** ***Tourism and Development in the Developing World*****.** London: Routledge**.**

Further Reading

1) Page, S. (2009). *Transport and Tourism: Global Perspectives.* New Jersey: Pearson Education.

2) Andrew Holden (2007). *Environment and Tourism.* London: Routledge**.**

AGRICULTURAL GEOGRAPHY 3 CREDIT HOURS

Purpose of the course

This course introduces students to the field of agricultural geography looking at the fundamental principles and concepts in agricultural geography. The course also looks at the Purpose of the courses, requirements and approaches to rationalization and classification in agricultural geography. The course also emphasizes the role of agriculture in economic development while laying emphasis on the new developments in agriculture.

Expected learning Outcomes

By the end of the course students should be able to:

1. Discuss the fundamental principles and concepts in agricultural geography

2. Explain the Purpose of the courses, requirements and approaches to regionalization and classification in agricultural geography
3. Analyze the factors that influence agricultural decision making
4. Explain how natural ecosystems are transformed into agricultural systems
5. Assess the role of agriculture in economic development
6. Examine the new technological developments in agriculture

Course Content

Nature and scope of agricultural geography, fundament principles and concepts in agricultural geography, regionalization and classification in agricultural geography, agriculture and decision making, natural ecosystems and agricultural systems, energy in agricultural, biological bases of farming, problems and potentials of tropical agriculture, political factor in agriculture, world's agricultural systems, technological innovations in agriculture, food and agricultural crisis in Africa, the green revolution and the Asian models of agricultural development, perceptions in agricultural geography, von Thunen's model of agricultural location, research in agricultural geography, sustainable agriculture, agricultural marketing, agricultural policies.

Mode of Delivery

Lectures, class discussions, practical exercises, field work, drawing of maps, class presentations, small buzz groups, book reviews and use of guest speakers.

Course Assessment

Type	**Weighting**
Continuous assessment tests and practical exercises	30%
Final examination	70%

Instructional Materials

Chalkboard, Required textbooks, charts, class handouts, PowerPoint presentation, overhead projectors, transparencies, DVDs, CDs, LCDs, maps, satellite imageries, aerial photographs and documentaries.Recommended Reference Materials

Required textbook

1) Rumney, T. A. (2009). The Study of Agricultural Geography: A Scholarly Guide and Bibliography. Lanham: Scarecrow Press.

Further Reading

1) Manionn, A.M. (1995). *Agricultural and Environmental Change: Temporal and Spatial Dimensions*. New York: John Wiley & sons.

2) Singh, J. and Dhillon, S. (1994). *Agricultural Geography*. New Delhi: Tata McGraw-Hill.

Relevant websites

http://geography.about.com/od/urbaneconomicgeography/a/aggeography.htm

www.answers.com/topic*/agricultural-geography*

http://en.wikipedia.org/wiki/Tourism_geography

http://www.geog.nau.edu/rts/