NATIONAL METEOROLOGICAL TRAINING SCHOOL

TRAINING CURRICULUM FOR DIPLOMA IN METEOROLOGY AND CLIMATE SCIENCE (DMCS)

MAY, 2024

Ministry of Water and Environment

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LIST OF ACRONYMS AND ABBREVIATIONS

CGPA : Cumulative Grade Point Average

COP : Conference Of Parties

DMCS: Diploma in Meteorology and Climate Science

GCFS: Global Climate Framework Services

GPA : Grade Point Average

IPCC : Intergovernmental Panel on Climate Change

MWE : Ministry of Water and Environment

NEMA : National Environment Management Authority

NFA : National Forestry Authority

NMTS : National Meteorological Authority

QMS Quality Management System

UNFCCC : United Nations Framework Convention on Climate Change

UNMA : Uganda National Meteorological Authority

WMO : World Meteorological Organization

1.0 TITLE OF THE PROGRAMME: This programme shall be called Diploma in Meteorology and climate science

2.0 BACKGROUND

Weather and climate information is valuable in several sectors such as agriculture, transport, water, communication, tourism, human and animal health, civil works, and disaster preparedness among

others. Due to climate variability and climate change, there is an increased demand for weather and climate services. Generation of high quality and reliable weather and climate information require adequately trained human resources. National Meteorological Training School has predominantly offered Diploma and Certificate programmes in Meteorology.

Since the school started training meteorological technicians, the curriculum for Diploma in Meteorology had not been reviewed but science has been evolving very fast in light of new advances in technology and rapidly changing climate. Therefore, this motivated the current review.

3.0 Justification of the programme

Most sectors of the economy depend on weather and climate. Moreover, climate change which has manifested itself through increased climate extremes such as floods and landslides, droughts, and increased cases of lightning strikes. These weather-related hazards threaten the economic gains that Uganda has made. This therefore, makes weather and climate information very important in the sustainable development of Uganda.

NMTS is the only institution in Uganda that trains meteorological technicians who are crucial in the provision of the much-needed weather and climate services. These technicians have for past 15 years been trained based on the same curriculum. Considering the changes in science and technology, it is important that the curriculum is reviewed.

4.0 Objective of the Programme

4.1 Main Objective:

To produce a competent meteorological technician who is able to undertake basic maintenance of weather instruments, observe weather elements, undertake data quality control, analyze, transmit and contribute to the forecasting process.

4.2 Specific Objectives:

- To produce meteorological technicians with high level of skills, competency and right attitude to serve in Uganda National Meteorological Authority (UNMA) and other sectors of the economy.
- To produce meteorological technicians who can undertake research.

- To prepare meteorological technicians for further studies in meteorology and other disciplines.

Learning outcomes

- Observe weather elements
- prepare observation reports to aid the forecasting process
- undertake data quality control,
- process and analyses data
- transmit data and information
- Install and maintain weather instruments

4.3 Definition of terms

Semester:

One standard semester shall comprise of:

- 15 weeks of teaching and learning
- 2 weeks of examinations

Contact Hours (CH)

A contact hour shall be equivalent to one (01) hour of Lecture or two (02) hours of tutorial/practical/field work or eight (08) hours of Industrial Training.

Credit Unit (CU)

A credit unit is a measure that shall be used to reflect the relative weight of a given course towards the fulfillment of a Diploma in meteorology. One credit unit shall be one contact hour per week or a series of fifteen (15) contact hours.

Core module:

A core module is one, which is essential to an Academic Programme and gives the Academic Programme its unique features. All the students who have registered for a particular programme take this course and must pass it.

Non-core module

A non-core module is one offered in order to broaden an Academic Programme or to allow for specialization. It is chosen from a given group of modules largely at the convenience of the student.

Audited module:

An audited module is one taken by a student for which a credit unit is not awarded.

Pre-requisite module:

A Pre-requisite is a condition (either course or classification) which must be satisfied prior to enrolling for the course in question. Pre-requisite Course, therefore, is a course offered in preparation for a higher-level course in the same area of study.

5 Resources

The programme requires significant amount of resources ranging from personnel to space and equipment. Most of these are already in place, given that the programme has already been running.

5.1 Staffing

NMTS currently has 15 well-trained teaching staff capable of handling the programme with an additional support sought from UNMA headquarters whenever necessary (See appendix 1).

5.2 Scholastic Materials

The sources of materials include Meteorology reference books at NMTS, UNMA and e-libraries. The school also has a fully functional computer laboratory with twenty (20) computers connected to the internet. There is a well-equipped demonstration weather station for both manual and automatic observations.

Specialized material such as weather charts maps, tephigram and other instruments are available to support practical teaching and learning. For additional practical exposure of the learners, the school organizes regular study tours to various study and operational centres.

5.3 Space

The school has enough space to accommodate this programme. It already has 08 lecture rooms, one computer laboratory, one library and 18 offices (**Please see appendix 2 and 3**)

5.4 Funding

This programme shall be funded by government and private sponsored students. The fees charged shall be one approved by the school management and the UNMA board.

6 Admission requirements

Admission to the Diploma in Meteorology and climate science programme shall be through two ways; Direct entry and Certificate scheme.

6.1 Direct entry

Applicants seeking admission through this scheme must have obtained;

(i) Uganda Certificate of Education (UCE) with at least five (05) passes two of which must be in Mathematics and English; and

(ii) Uganda Advanced Certificate of Education (UACE) with at least One (01) Principal Pass in either Physics or Mathematics and Two (02) Subsidiary Passes from science subjects taken at Principal Level obtained at the same sitting. For purposes of computing entry points, the advanced level subjects shall be classified as follows:

Essential subjects - Mathematics and Physics
Relevant - Geography, Economics, Chemistry, Biology
Others - General Paper and any other subject done

6.2 Certificate entry

(i) Applicant should possess Uganda Certificate of Education (UCE) with at least five (05) passes two of which must be in Mathematics and English; and

(ii) At least a credit Certificate in either Meteorology or any other physical science field that is nationally recognized.

7 General Regulations

This section explains the regulations that will govern the programme.

7.1 Name of the diploma

This programme shall be called a Diploma in Meteorology and Climate Science (DMCS)

7.2 Nature of the programme

This shall be a day programme for both government and privately sponsored students.

7.3 Duration of the programme

The programme shall take two years

7.4 Earning a credit in a course

Students shall earn credits for all the courses specified in the programme load for graduation. A credit is earned when a course has been passed. The minimum pass mark in any course shall be 50%.

7.5 Academic Progress

Progression through the programme shall be assessed in three ways:

Normal Progress (NP)

This occurs when a student passes each course taken with a minimum GP of 2.0.

Probational Progress (PP)

This is a warning stage and occurs if either the CGPA is less than 2.0 and/or the student has failed a core course. Probation is weaved when conditions cease to hold.

Retaking a module(s)

a) A student shall retake a **module(s)**when next they are offered again in order to obtain at least the pass mark (50%) if she/he had failed during the first assessment in the course(s)
b) While retaking a **module(s)**a student shall: -
    i. Attend all the prescribed lectures/tutorials/practical/field work in the course(s)

ii. Satisfy all the requirements for the coursework component in each course(s).

iii. Sit for the end of semester examinations in the course(s).

c) Whenever a course(s) has (have) been retaken, academic transcript shall indicate so.

Discontinuation

i. A student who has failed to obtain at least the pass mark (50%) during the third assessment in the same course(s) he/she had retaken shall be discontinued from his/her studies at the school.

ii. A student who has overstayed in an academic programme by more than two years shall be discontinued from his/her studies at the school.

Absence from Examination

i. If the academic board found out that a student has no justifiable reason for having been absent from a particular examination, such a student shall receive a fail (F) grade for the course(s) he/she had not sat the examination in. The course(s) in which the Fail (F) grade was (were) awarded shall count in the computation of the CGPA.

ii. If the academic board found out that a student was absent from a final examination due to justifiable reason(s) such as sickness or loss of a parent/guardian, a course grade of ABS shall be assigned to that course(s). The student shall be permitted to retake the final examination when the course would be next offered or the next examination season if the lecturer concerned can make the appropriate arrangements for the examination.

8 Mode of delivery

- Most instruction is by lecture method. Students are allowed to interact with Lecturers, by asking questions and contributing to the flow of the lecture.
- Tutorials are organised by respective lecturers, where students are encouraged to solve problems by themselves
- Practical and field studies/ tours, attachment/coaching sessions are encouraged in this programme. Students will be guided by course instructors and tutorial assistants assigned to the course.
- Student discussion groups are encouraged outside lecture time. Use of other resources, including internet, is encouraged.

9 Grading

The overall marks a candidate obtains in each course he/she took shall be graded out of a maximum of one hundred (100) marks and assigned appropriate letter grades and Grade Points as follows:

UBTEB Grading System for Specialized Training Institutions Diploma programme.

Marks Boundary (%)	**80.0-100.0**	**75.0-79.9**	**70.0-74.9**	**65.0-69.9**	**60.0-64.9**	**55.0-59.9**	**50.0-54.9**	**00-49.9**	**-1.0-1.0**
Letter Grade	A	B+	B	C+	C	D+	D	F	MS
Grade Point (G.P)	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	-1.0

Grade Point Average (GPA)

The GPA is calculated by three-step procedure: (1) multiply the grade points for each course by the number of CU for that course; (2) add the figures for each of these courses to arrive at the grade point total; (3) divide this grade point total by the total number of credits (CU) for which a grade was received.

Cumulative Grade Point Average (CGPA)

i. Multiplying the grade point obtained in case course by the Credit Units (CU) assigned to the course to arrive at the weighted score for the course.

ii. Adding together the weighted scores for all the courses taken up to that time.

iii. Dividing the total weighted score by the total number of Credit Units taken up to that time.

Semester load

A normal programme load per semester shall be 21 – 26 CU.

A learner is considered to be making satisfactory progress towards a diploma in meteorology and climate science objective when he or she achieves the GPA of 2.0 in each semester required for his/her classification.

9.1 Classification of the Diploma

The Cumulative Grade Point Average (CGPA) for the various classes shall be as indicated in the table below.

Qualification of awards for specialized training institution programme

CGPA Boundary	**4.4 – 5.0**	**2.80 – 4.39**	**2.00 – 2.79**	**-1.0-1.99**
Class of Award	Class I (Distinction)	Class II (Credit)	Class III (Pass)	Fail
Explanations for Class of Award	Excellent Competences Acquired	Competences Above Average Acquired	Average Competences Acquired	Inadequate competences acquired

9.1.1 Course work (CW)

i. Course work shall consist of marks obtained in tests, assignments, practical, tutorials, presentations and field work. At least one assignment, one test and one practical (where applicable) shall be administered.
ii. Course work shall contribute 40% of the final mark in each course.

9.1.2 Assessment mode

Each module shall be assessed in two parts as follows:

i. The course work shall contribute 40% of the total mark and shall consist of marks obtained in tests, assignments, practical, tutorials, presentations and field work. At least one assignment, one test and one practical (where applicable) shall be administered.
ii. Course work

iii. The final examinations, which will be done at the end of the semester shall contribute 60% of the final mark.

Pass Mark

A candidate is deemed to have passed the semester assessment if he/she obtains at least 50% of the marks in each module,

9.1.3 Graduation requirements

i. Completion of the school's core curriculum.
ii. A CGPA of at least 2.0.

10 Curriculum

10.1 Duration

The curriculum for the programme shall cover a period of four (04) semesters. Each course will be covered in fifteen (15) weeks of the total seventeen (17) week long semester. The last two weeks of the semester are slated for examinations.

10.2 Structure of the Programme

The teaching will include lectures, practical, study trips, projects and tutorials. Every student registered for this programme shall take the prescribed course units as indicated below, where; L = Lectures, P = Practical, CH = Contact Hours, PH = Practical Hours, CU = Credit Unit.

10.3 Programme summary

Year one					
Module code	**Module Name**	**LH**	**PH**	**CH**	**CU**
Semester 1					
DM 111	Mathematics	45	30	60	4
DM 112	Physics	45	30	60	4
DM 113	Meteorological Instruments, Codes and Methods of Observation	30	60	60	4
DM 114	Statistical Methods	30	30	60	4
DM 115	Communication and life Skills	30	30	45	3
DM 116	Introduction to computer applications	15	90	60	4
DM 117	Gender and climate	30	30	45	3
Total semester load = 26					
Semester 2					
DM 121	Vector Analysis	30	30	45	3
DM 122	Physical Meteorology I	30	30	45	3
DM 123	Climate System and Analytics	30	30	45	3
DM 124	Synoptic Meteorology	30	30	45	3
DM 125	Remote Sensing	30	30	45	3
DM 126	Research Methods	30	30	45	3
DM 127	Principles of Geographic Information Systems (GIS)	15	90	60	4
Total semester load = 22					

YEAR TWO					
Course Code	**Course Title**	**LH**	**PH**	**CH**	**CU**
Semester 1					
DM 211	Tropical Meteorology	30	30	45	3
DM 212	Dynamic Meteorology I	30	30	45	3

DM 213	Physical Meteorology II	30	30	45	3
DM 214	Agrometeorology	30	60	60	4
DM 215	Climate Change, Mitigation and Adaptation Strategies	60	00	45	4
DM 216	Environmental Pollution and Control	30	30	45	3
DM 217	Entrepreneurship Skills	30	30	45	3
DM 218	Statistical Software for data analysis	15	60	45	3
Total semester load = 26					
Semester 2					
DM 221	Dynamic Meteorology II	45	00	45	3
DM 222	Aviation Meteorology	30	30	45	3
DM 223	Principles of weather forecasting	30	60	60	4
DM 224	Hydrometeorology	30	30	45	3
DM 225	Research Project	15	120	75	5
DM 226	Industrial Training	00	360	45	3
Total semester load = 21					

11. Detailed module description

11.1 YEAR ONE, SEMESTER ONE

DM 111: Mathematics – 60 Hours

Module Code and Name: DM 111 MATHEMATICS **Level: YEAR I, SEMESTER I** **Module Credit: 4CU**
Module description The course unit aims at strengthening the mathematical component which is very vital to the study of meteorology together with its related applications in our everyday life.
Learning outcomes Upon successful completion of this module, the learner should be able to compute metric measurements in meteorology and apply mathematical concepts to explain the dynamics of the atmosphere

Competences The learner: • Solves mathematical equations • Applies mathematical concepts to explain the dynamics of the atmosphere	
Detailed Module Description The module aims at strengthening the mathematical component which is very vital to the study of meteorology together with its related applications in our everyday life.	**Duration**
Sub module 1: Algebra • Equations: Linear and quadratic functions • Matrices - inverse and determinants up to the third order and applications • Remainder theorem • Series: Arithmetic Progression and Geometric Progressions • Functions: Exponential, Logarithmic and hyperbolic functions • Binomial theorem and its application • Complex numbers: cartesian and polar forms, including De Moivre's theorem	**20 hours**
Sub module 2: Calculus • Differentiation o Polynomial functions (product, quotient and chain rule, parametric equations, implicit functions and rates of change) o Trigonometric and inverse functions o Logarithmic and Hyperbolic functions • Series: Taylor's and Maclaurin's expansions • Integration o Methods of integration o Change of variables o Solids of revolution, • Differential equations: Linear first order and Linear second order	**20 hours**
Sub module 3: Geometry • Locus and circle • Conic section: equation of a parabola, ellipse, hyperbola • Elementary trigonometry • Parametric equations	**12 hours**
Sub module 4: Numerical Methods • Location of roots of an equation - Linear interpolation and extrapolation, Newton Raphson method and the general iterative technique • Approximate techniques for integration - Trapezium rule, Simpson's rule	**8 hours**

Mode of delivery The module will be taught by using lectures, discussions, demonstrations, discovery, illustrations and assignments.
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**

References:

1. Pure Mathematics 1 and 2 by J. K. Backhouse, S. P. T. Houldsworth, P. J. F. Horril · 1985
2. Understanding Pure Mathematics by Thorning and Sadler, Oxford University Press, 1987
3. Advanced level Mathematics by Tranter (4th Edition 1975)
4. Stroud, K. A., and Dexter, J. B., (2003), Advanced Engineering Mathematics. 4th edition. CPD (wales) Ltd, Ebbw Vale
5. K A Stroud, (1984), Engineering Mathematics, Programmes and Problems, MacMillan Publishers Ltd, ISBN 0 333 34052 3
6. John, B., (2007), Engineering Mathematics. 5th ed. Linacre House, Jordan Hill, Oxford OX2 8DP, UK
7.

DM 112: Physics – 60 Hours

Module Code and Name: DM 112: PHYSICS **Level: YEAR I, SEMESTER I** **Module Credit: 4CU**	
Module description This module is concerned with understanding physics concepts in the natural environment. It introduces learners to mechanics, light, waves, electricity and magnetism.	
Learning outcomes By the end of this module, learners should be able to explain different physics concepts, apply them in meteorology as well as describe the physical processes in the atmosphere.	
Competences The learner: • Explain concepts in physics • Apply different laws of physics to explain natural phenomena • Describe physical phenomena	
Detailed Module Description	**Duration**
Sub module 1: Mechanics • Units and dimensions • Vectors and scalars – Resolution, Composition, Resultant vector and relative motion	**15 hours**

• Newton's law of Motion and their applications • Forces (fundamental and fictitious forces) • Motion with a varying mass (Aircraft/Rocket engines, crystalline substances) • Conservation laws (energy, momentum) • Work, energy and power • Simple harmonic motion • Frames of references - Rotating and non-rotating frames • Moment of inertia	
Sub module 2: Optics, Waves and Sound • Reflection of light, • Refraction of light, Refractive indices, • Dispersion of light • Polarisation • Electromagnetic spectrum, • Optical instruments • Progressive waves (general wave equation, types, characteristics) and sound • Resonance and Transients	**15 hours**
Sub module 3: Thermodynamics • Concept of heat, temperature and its measurements, • Heat transfer processes • Gas laws, equation of state, kinetic theory of matter and applications • Thermodynamic equilibrium, 1st and 2nd laws of thermodynamics, • Thermodynamic processes - isothermals and adiabatic process and their respective reversible processes • Entropy and heat engine	**15 hours**
Sub module 4: Electricity and magnetism • Electrostatics • Electric field and electric potential • Current electricity/direct current (D.C) and alternating currents (A.C) • Electrical measurements • Magnetic field • Applications of electromagnetism (electric bell, transformer) • Terrestrial magnetism	**15 hours**
Mode of delivery This module will be taught by using lectures, discussions, demonstrations, experiments, projects and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%)	

Final Assessment: 60% **Total 100%**

References:

1. Advanced level Physics by Michael Nelkon, Philip Parker 1995 .
2. Advanced level Physics by Roger Muncaster · 1993
3. Advanced level Physics for today and tomorrow by Tom Duncan · 1983

DM 113: Meteorological Instruments and Methods of Observations – 60 Hours

Module Code and Name: DM 113 METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATIONS **Level: YEAR I, SEMESTER I** **Module Credit: 4CU**	
Module description This module deals with weather instruments and methods of observing different weather elements. It further looks at coding, transmission and decoding of weather information.	
Learning outcomes By the end of this module, learners should be able to use different weather instruments, maintain them, encode and decode weather data, prepare weather reports, plot weather data and transmit meteorological data.	
Competences The learner: • Identify different weather instruments • Observe weather • Plot weather data • Prepare weather reports	
Detailed Module Description	**Duration**
Sub module 1: Principles of meteorological measurements • Definition of terms (weather, climate, meteorology) • Regulatory organizations (WMO, ICAO, IGAD, ICPAC, UNMA) • The World weather watch (WWW) • Classifications of: weather observations; instruments and stations. • Automatic weather observing systems, Radars, satellite, upper air observations • Weather station installation (siting, factors considered for buying equipment) • Compare automatic and manual observations • Network, Siting, standardization of meteorological stations and instruments. • Methods and procedures of calibration of instruments • standard time versus official time of observation • Duties of a meteorological technician.	**10 Hours**

• Applications of weather data.	
Sub module 2: Meteorological Elements and their Measurements • Meteorological elements and their units of measurements (Sunshine, Temperature, pressure, wind direction and force, Clouds, relative humidity, precipitation, Visibility). • Meteorological instruments: Exposure, Principle of operation, Maintenance and Sources of errors. • Method of observations for different weather elements.	**15 hours**
• **Sub module 3: Meteorological Codes and Plotting** • Traditional Alphanumeric Codes (TAC) report: • METAR/SPECI (frequency, Structure,) • Meteogram (plotting model and code symbols). • SYNOP/SHIP (frequency and Times of Issue, Structure, encoding and decoding) • Surface chart plotting model and code symbols • TEMP (Time of Issue, Structure, encoding and decoding, upper air chart plotting model, Tephigram plot and applications in meteorology). • Special Codes (Decoding and encoding) • Table Driven Code Forms (TDCF) • CREX: Character Representation and Exchange (encoding and decoding, advantages and disadvantages) • BUFR: Binary Form of Representation (encoding and decoding, advantages and disadvantages) • IWXXM codes for ICAO (OPMET)	**30 Hours**
Sub module 4: Quality Control and Transmission of Meteorological Information • Internal Quality control measures (QMS-procedures) and avoidance of errors • Data flow and transmission tools.	**5 hours**
Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Mike M.N Mwebesa (1976): East African Observer's Handbook, (handbook of standard procedures for surface weather observing and recording of climatological data) Rev. Ed east African community, East African Meteorological Dept. in Nairobi.
2. Severe Pettersen (1956): weather analysis and forecasting, volume 1, McGraw-Hill
3. C. Donald Ahrens, Essentials of Meteorology 2014; An invitation to the Atmosphere
4. Roger G. Barry and Richard J. Chorley, Atmosphere, Weather and Climate, 1970, 9th Edition.
5. Guide to meteorological instruments and methods of observation: Seventh edition, 2008.

DM 114: Statistical Methods – 60 Hours

Module Code and Name: DM 114 STATISTICAL METHODS **Level: YEAR I, SEMESTER I** **Module Credit: 4CU**	
Module description This module focuses on various statistical methods that can be used in the analysis of meteorological data to generate information for planning and decision making by end users.	
Learning outcomes By the end of this module, learners should be able to use different data collection tools and methods, control data quality, analyze meteorological data to generate information that support decision making as well as generation of simple linear regression models.	
Competences The learner: • Collect data • Organize meteorological data • Analyze data • Interpret data • Present data • Make evidence based decision making	
Detailed Module Description	**Duration**
Sub module 1: Introduction to statistics • Definitions • Types of statistics • Importance of statistics • Data types • Data Collection methods and tools,	**6 hours**
Sub module 2: Descriptive statistics • Data presentation • Measures of central tendency: mean, mode, and median • Measures of dispersion: range, standard deviation and variance, quartiles, coefficient of variation • Skewness and kurtosis	**8 hours**

Sub module 3: Methods of data analysis • Estimation of missing values (averaging, normal ratio, interpolation and extrapolation methods), data quality control and tests of data homogeneity (single and double mass curves) and adequacy. • Common errors in the measurements of continuous and discrete variables	**10 hours**
Sub module 4: Measures of relationships between variables. • Correlation coefficients • Linear regression analysis	**10 hours**
Sub module 5: Probability theory • Definition of terms • Simple probability (possibility space, independent events, mutually exclusive events, events that are not mutually exclusive) • Set notation • Sum and product laws • Conditional probability • Probability involving permutations and combinations	**8 hours**
Sub module 6: Random variables: • Discrete - Binomial distribution • Continuous- Normal	**8 hours**
Sub module7: Sampling • Sampling techniques: probabilistic and non-probabilistic sampling techniques, • Methods of sampling – simple random, stratified, cluster sampling among others and determination of sample size, • Hypothesis testing- The student's t-test, Chi-square (χ^2), Significance tests of research hypotheses	**10 hours**
Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Murray R. Spiegel and Larry J.S (2008): Theory and Problems of Statistics,4Th Edition, McGraw-Hill
2. Collins K.J et al 9th Edition (2000) , Research in the Social Sciences

3. Ronald E.Walpole, 3Rd Edition (1982), Introduction to Statistics.
4. Janet Crawshaw, Joan Chambers · 2001, Advanced level statistics with worked examples, fourth edition
5. Gregory S (1968). Statistical Methods and Geographer, second edition Longmanns

DM 115: Communication and Life Skills – 45 Hours

Module Code and Name: DM 115 COMMUNICATION AND LIFE SKILLS **Level: YEAR I, SEMESTER I** **Module Credit: 3CU**	
Module description This module is intended to enhance the learners' knowledge and skills of effective communication within their environment.	
Learning outcomes By the end of this module, learners should be able to effectively communicate both orally and in writing, use different tools and channels for communication.	
Competences The learner: • Defines communication. • Identifies the importance of communication in organizations • Classifies the categories of communication. • Applies the different forms of communication. • Describes the elements of communication. • Identifies barriers to Effective communication • Writes communication • Writes business correspondence, letters, CV, Memos and reports.	
Detailed Module Description	**Duration**
Sub module 1: INTRODUCTION TO COMMUNICATION SKILLS • Definition and process of communication. • Importance of communication. • Types of communication • Communication channels. • Communication flows: upward, downward and horizontal communication • Forms of communication • Internal and external communication.	**5 hours**
Sub module 2: ELEMENTS OF COMMUNICATION PROCESS. • Planning for communication (consultation, drafting, choose appropriate tools and methods) • Effective communication: Communication etiquette, methods of effective communication, barriers to effective communication, impact of ineffective communication	**6 hours**

Sub module 3: CORRESPONDENCES. • Language Syntax (spelling, synonyms, verbs, adjectives, summary writing) • Note-taking: importance of taking notes and how to take good notes • Writing of memo and loose minute • Writing of application letter and curriculum vitae • Questionnaires. • Circulars (formats, types and importance) • Notices (formats, types and importance) • Writing business letters: importance of business letters, principles of effective letter-writing, and elements of a business letter • Cover letter and other letters • Press releases (types, procedures)	**10hours**
Sub module 4: MEETINGS. • Definition and purpose • Terms used in meetings (agenda, minutes, venue.) • Organizing and conducting effective meetings • Types of meetings. • Roles of the chairperson, secretary and members in a meeting • Documents used in meetings • Committees (Merits and limitations of Committees).	**4 hours**
Sub module 5: PUBLIC SPEAKING • Types of public speaking. • Stage fright (Nervousness) Causes and how to overcome it • Interviews: types of interviews, preparing for an interview, handling questions in an interview, and organizing an interview • Negotiation; procedure, rules, considerations, challenges and how to overcome them.	**8 hours**
Sub module 6: COMMUNICATION CHANNELS AND TOOLS • Communication tools; Telephone, Radios, Television, Mails and Print Media • Communication Channels; Face to face or Personal; Video and Audio conferencing; Electronic channels (electronic mails social media); Publications; articles, magazines; folk media	**6 hours**
Sub module7: LISTENING AND READING SKILLS • Definition of terms. • Stages of listening. • Importance of listening. • Causes of poor listening and remedies. • Text reading	**6 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows	

Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**

References

1. Steanblerg, S (1997), introduction to communication, 3rd edition. Durban: JUta& Co.
2. Stanton N (2004), Mastering Communication 4th edition. Pelgrave Macmillan
3. Carlin D and J Payne (1989), public speaking today. Chicago: NTC publishing group.
4. Brig. (Dr.) R. S Grewal VSM, Communication skills, (2007)
5. DeVito, J A (2009), The Interpersonal Communication book
6. Richard C. Gebharot Dawn Rodrigues. (1989), Writing Processes and intentions: DC Health and Company
7. Sher, W. (1986). Writing for Excellence. Longman

DM 116: Introduction to computer applications – 60 Hours

Module Code and Name: DAM 116 INTRODUCTION TO COMPUTER APPLICATIONS **Level: YEAR I, SEMESTER I** **Credit: 4 CU**	
Module description This module introduces the learner to computer enabling them prepare, manage and share documents. It also equips leaners with knowledge and skill of computer maintenance and internet browsing.	
Module objective: To enable learners, apply acquired computer knowledge and skills to enhance performance in their day-to-day operations	
Learning outcomes By the end of the module, the learner should be able to; • Identify different components of a computer • Use computer hardware and software • Manage computer files • Design print media • Processing numerical data • Prepare and make presentations • Browse the internet	
Indicative content	**Duration**

1. Computer basics a) Introduction: • History of computers • The future of computers • Computer generations and classification b) Computer system: • Meaning • Types of computers • Types of data/ Information processing • Caring for computers • Data and computer security and risks • Ergonomics (physical health and mental health) • Computer ethics c) Information technology: • Meaning • Manual versus computerized systems • Limitations of using computers • Applications • Social impact of computers and information technology	**6 hours**
2. Hardware components of a computer a) Introduction: • Meaning of hardware • Hardware parts of the computer b) Input devices: • Meaning and associated characteristics • Types and examples of input devices • Utility of input devices in business solutions • Maintenance and security of input devices • Input device specifications, characteristics and capabilities c) Output devices: • Meaning • Types and examples of output devices • Utility of output devices in business solutions • Mmaintenance and security of output devices • Output device specifications, characteristics and capabilities d) Storage devices: • Meaning and characteristics of computer storage • Primary storage devices • Secondary storage devices • Storage device selection • Purpose and role of computer hardware e) Processing devices (CPU) f) Uninterrupted power supply **g)** Ports and cables	**4 hours**

3. Software components of a computer a) Computer software: • Meaning • Characteristics and applicability of computer software to businesses • Types • Application packages and suites b) Operating systems: • Meaning and characteristics • Functions • Types and examples c) Utility programs: • The role of utility programs as common computing requirements • Characteristics and examples • Commonly used utility programs d) Programming languages: • Meaning and characteristics • Generation languages (machine code to artificial intelligence)	**4 hours**
4. Data communication **a) Data transmission:** • Data communication • Transmission and control of data • Components of data communication **b) Computer networks:** • Meaning of computer network and applicability • Types and characteristics of networks • Network architecture and protocols • The internet and the world wide web, Web browsers and search engines • Electronic mail services; Opening an email address, composing, saving, sending, and receiving mail, downloading documents, attaching files. • Social media **c) Network topologies** • Meaning, interconnection of elements and characteristics of network topologies • Basic types of network topologies and connectivity • Selection of network topology d) **Network models** • Meaning, characteristics and applications of: Client-server system and Peer-to-peer models	**8 hours**
5. Care and security of computer systems and networks a) Meaning and characteristics of computer virus b) Meaning of software and data security c) Dangers to computer software and information systems d) Precautions and safeguards against data/file loss **e)** Characteristics of antivirus software	**6 hours**

6. General information systems concepts a) Nature and types of information systems b) Information systems architecture c) Control and feedback in information systems d) Nature, types, value and role of information e) Office automation. f) Data and information: definition, distinction and characteristics, data processing cycle and value of information **g)** Models of data processing (real-time/online, batch processing, distributed and centralised processing)	**6 hours**
7. Hardware and software considerations a) Acquisition issues: identifying business requirements and recommending business solutions b) Classical systems development life cycle/ process: • Stages of the systems development life cycle pertaining to development of a business system • Relating failures or shortcomings with inappropriate/ inconsistent conduct/ omissions in the development cycle	**5 hours**
8. Terminologies of basic end-user packages a) Understanding how to use a computer; booting the computer **b) User interface:** • Types • Windows environment **c) Desktop components:** • Quick launch toolbar • Taskbar • Icons • Start button and menu • My computer • Task manager • Recycle bin d) File management: • Files and folders; creating a new folder • Copy/ move files from one folder to another • Drag and drop files • Create different file types with varying extensions • Create shortcuts to frequently used files or applications • Use of hard drive and other drives for file management • Renaming/ deleting folders or files • Using the recycle bin • Storage options: Internal and external drives, Flash drives, CDs/ DVDs, My computer, Save As, Save and Exit without changes	**5 hours**

9. Word processing. a) **Familiarizing with the MS Word interface**: • The Quick access toolbar • The Title bar • The Ribbon; The Ruler: the text area, the vertical and horizontal scroll bars • The Status bar • Understanding document views: minimize, maximize, close and resize buttons • Understanding non-printing characters • Executing commands with keyboard shortcuts • Zoom slider • Starting a new paragraph • Help **b) Creating a basic document:** • Creating a blank document • Customizing the word environment • Entering text • Saving files and exiting word **c) Editing a document:** • Navigating and selecting text in a document • Inserting, deleting, or rearranging text • Undoing changes • Searching and replacing text • Cutting and pasting • Copying and pasting • Using the clipboard • Finding and replacing • Checking spelling, grammar and word count • Enhancing textual meaning using the thesaurus Customizing autocorrect options • Previewing and printing documents **d) Formatting text and paragraphs:** • Changing font appearance • Highlighting text • Adding bullets and numbers • Setting tabs to align text • Paragraph layout • Borders and shading • Applying styles • Creating lists • Managing formatting • Adding spaces before or after paragraphs • Changing line spacing • Creating first-line indents • Indenting paragraphs	**6 hours**

- Aligning paragraphs
- Creating hanging indent

e) Tables:

- Creating
- Modifying
- Formatting
- Converting text to tables or tables to text

f) **Inserting graphic objects**:

- Adding visual effects using symbols and special characters
- Inserting illustrations, clip art

g) Managing page appearance:

- Page layout
- Borders and colours
- Watermarks
- Headers and footers
- Page numbering
- Orientation
- Page size
- Margins
- Page and section breaks

10. Basic Presentation a) The fundamentals of presentation b) Presentation basics c) Formatting a presentation d) Working with objects e) Working with tables f) Working with charts and smart art g) Applying transition and animation effects **h)** Finalizing a presentation	**5 hours**

11. Spreadsheets and Microsoft Excel **a) Introduction to spreadsheets** • Characteristics of spreadsheet application • Application of spreadsheet software for day-to-day operations • Spreadsheet application functions: - inputting data, formatting, saving, and renaming • Spreadsheet data manipulation • Relative referencing and nested functions • Spreadsheet output b) Getting started with Excel: • Starting Excel • Excel working environment • Using the ribbon as the Excel user interface • Navigating within the worksheet/ workbook • Selecting a cell or range of cells • Entering data • Cutting, copying, and pasting cell values • Copy and paste special • Saving and opening a workbook c) Managing rows and columns: • Inserting, moving and deleting cells • Managing columns and rows • Hiding and unhiding rows/ columns • Formatting column widths and row heights d) Managing worksheets: • Formatting worksheet tabs • Inserting and deleting worksheets • Moving and copying worksheets • Hiding and unhiding worksheets e) Formatting cells: • Number and date formatting • Finding and replacing text • Working with styles f) Working with formulas and functions: • Entering formulas • Arithmetic operators and order of operations • Using auto-fill options • Using commonly used functions e.g VLookup, Sum, IF, Max and Min, Sumif, Countif, And, Or, Left, Right and Concatenate, Round, Proper, Now g) Organizing worksheet and table data: • Creating and modifying tables • Sorting and filtering data in tables • Summarizing information in tables h) Working with charts: • Summarizing data visually using charts	**9 hours**

- Customizing chart data
- Formatting chart legend and titles
- Changing chart bodies
- Saving charts as templates
- Creating pie-charts

i) Managing workbooks:

- Linking worksheets
- Printing worksheets
- Setting page setup options
- Setting page breaks

12. Databases a) Characteristics of a database application/system b) Types of databases c) Application of database system software for day-to-day business operations d) Database applications hands-on e) Character, field, record, table, database f) Database objects: tables, queries, forms and reports g) Entity and attributes h) Data types, primary key, foreign key **i)** Data input, manipulation, reporting and saving	**12 hours**
Mode of delivery ➢ Hands on practices ➢ Workshops and discussions ➢ Lectures	
Mode of assessment ➢ **Course work** • Practical Assignments 20% • Practical Tests 20% ➢ **Final Examination 60%** ➢ Total 100%	

References:

1. Tukamushaba E & Moya M (2007): Practical Approach to ICT
2. Microsoft office suite manual (usually for all Microsoft packages)
3. Bocij Paul, Chaffey Dave, Greasley Andrew and Hickie Simon (2008), Business Information Systems: Technology, Development and Management in the E-Business, Prentice Hall. Special Edition.

DM 117 : Gender and Climate – 45 Hours

Module Code and Name: DM 117 GENDER AND CLIMATE **Level: YEAR I, SEMESTER I** **Module Credit: 3CU**
Module description This module focuses on understanding different gender concepts and their application in daily life as well as its mainstreaming in natural resources management and provision of weather and climate services.
Learning outcomes By the end of the module, learners should be able to Explain different gender concepts, Apply different gender concepts in the management of natural resources and in provision of weather and climate information services. The learner should also be able to advocate for gender mainstreaming, examine the role of gender in sustainable natural resource use and management and also evaluate different gender legal frameworks
Competences The learner:

• Defines gender concepts • Explains purpose for gender mainstreaming • Relates gender to socioeconomic development	
Detailed Module Description	**Duration**
Sub module 1: Introduction to gender • Definition of key concept(s): gender', difference between gender and sex, gender equality and equity, gender discrimination and gender gaps. • Why 'gender' matters? • Assumptions about gender. • Socialization spaces: home, school, and print and electronic media, social media; socialisation agents: parents, peers, elders, community members. • Social construction of men and women in diverse contexts. • Social construction of gender vis-à-vis power, rights and responsibility. • Socialization and gender roles, responsibilities, behaviour, characteristics of women and men. • Gender based violence (forms of domestic violence, cycle violence, effects of domestic	**5hours**
Sub module 2: Gender roles in natural resource use & environmental management. • Definition of key concept(s): Access, Control, Resource Utilization, Use and Environmental management. • Roles of women and men in Natural Resource Use. • Case studies on gender and Natural Resource Utilization. • Impacts of Environmental Degradation on Women and men.	**6 hours**
Sub module 3: Gender, work and agriculture • Gender and division of labour in agriculture (Women do not own land but use the land that is owned by men, how do we improve access to and control over land resources by women?) • Gender and work for men and the triple roles of women (Paid versus unpaid work for men and women respectively, Productive work, Reproductive work., Community management) Women and social reproduction	**6 hours**
Sub module 4: Gender and Resources • Gender and access to resources (Land, Water, Healthcare, Education) • Practical gender needs (Access to agricultural inputs, Market, Water, Healthcare, Opportunities to earn an income) • Strategic gender needs (Family planning, right to speak, Measures against violence, Women's control over their own bodies, Eliminating the burden of domestic labour and child care, Challenging the gender division of labour)	**10 hours**

• Land tenure system (definition, key elements, different forms, Advantages and disadvantages of different land tenure systems in Uganda)	
Sub module 5: Gender, Vulnerability to impacts of climate change • Gender, and climate change relationship. • Gender and the access and utilization of weather and climate information • Gendered Impacts of Climate Change • Coping capacity and resilience under increasing climate extremes and natural disasters. • Gender & Climate Change-Legal framework	**10 hours**
Sub module 6: Gender, Environment and Sustainable Development • Gender, Environment and Sustainable development • Ecological movements initiated by women (Green Belt movement in Kenya) • Gender Responsive Environmental Policies and Programmes	**8hours**
Mode of delivery This module will be taught by using lectures, case studies, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

Reading lists

Muthuki, J. (2006). Challenging patriarchal structures: Wangari Maathai and the Green Belt movement in Kenya. *Agenda*, *20*(69), 83-91.

Boserup, E. (2007). *Woman's role in economic development*. Earthscan.

Njehu, N. N. (1996, November). Women and sustainable development: A case study of the Green Belt Movement of Kenya. In *Population and Environment* (Vol. 18, No. 2, pp. 220-221). 233 SPRING ST, NEW YORK, NY 10013-1578: HUMAN SCI PRESS INC.

Oakley, A (1985): Sex, Gender and society, Chapter 6. Gower publishing company.

Siltanen, J., and Stanworth, M. (1984). The politics of private woman and public man. *Theory and Society*, 13(1), 91-118.

Staudt, K. (1986). Women, development and the state: on the theoretical impasse. *Development and Change*, 17(2), 325-333.

Anaglo, J. N., Boateng, S. D., & Boateng, C. A. (2014). Gender and access to agricultural resources by smallholder farmers in the Upper West Region of Ghana. *Journal of Education and Practice*, *5*(5), 13-19.

Harrington, A., & Chopra, T. (2010). *Arguing traditions: Denying Kenya's women access to land rights*. World Bank.

Razavi, S. (2007). Liberalisation and the debates on women's access to land. *Third World Quarterly*, *28*(8), 1479-1500.

Piacenza, C. (2012). Negotiating gendered property relations over land: oil palm expansion in Kalangala district, Uganda. In *International Conference on Global Land Grabbing II, Cornell University*.

Asaba, R. B., Fagan, H., Kabonesa, C., & Mugumya, F. (2014). Women and access to water in rural Uganda: A review. *wH2O: The Journal of Gender and Water*, *3*(1).

Oakley, A (1985): Sex, Gender and society, Chapter 6. Gower publishing company.

Lorber, J, and Farrell, S. (1991). *The Social Construction of Gender*. Newbury Park/London/New Dehli: Sage Publications.

West, C., & Zimmerman, H. (1987). Doing gender. *Gender & Society*, *1*(2), 125–151. https://doi.org/10.1177/0891243287001002002

Oakley, A (1985): Sex, Gender and society, Chapter 6. Gower publishing company.

11.2 YEAR ONE, 2ND SEMESTER

DM 121: Vector Analysis – 45 Hours

Module Code and Name: DM 121 VECTOR ANALYSIS **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**
Module description This module focuses on representing atmospheric motions and processes using vectors and their applications in real-life situations.
Learning outcomes By the end of this module, students should be able to compute dot and cross product and relate them to meteorological phenomenon such as divergence, convergence, circulation and vorticity. They

should also be able to make vectorial illustrations as well as identify relationship between vectors and real-life situations	
Competences The learner: • Defines scalar and vectors • Applies dot and cross products • Relates dot and cross products to meteorology • Enhances understanding of three dimensional fields	
Detailed Module Description	**Duration**
Sub module 1: Vector and scalar quantities • Vectors and scalars • Representation of vectors • Components of a vector - Modulus and Direction of a vector • Unit and parallel vectors - rectangular unit vectors, Direction cosines	**6 hours**
Sub module 2: Algebra of vectors • Addition and subtraction of vectors - Laws of vector algebra • Multiplication and division of a vector by a scalar: collinear and parallel vectors • Resolution and composition of vectors -Resultant vector	**6 hours**
Sub module 3: Multiplication of vectors and their applications • Dot and Cross product of vectors • Equation of a line: Vector, Cartesian and parametric forms, Intersection of lines and angle between lines • Equation of a plane: Intersection of a line and a plane o Angle between a line and a plane o Intersection of (two and three) planes o Angle between two planes	**10 hours**
Sub module 4: Differentiation of Vector valued functions. • Limits, continuity and differentiation of vectors • Partial and total derivatives • Continuity and differentiability of vectors	**8 hours**

Sub module 5: Vector operators and Applications • Gradient of a scalar function, • Del or vector operator • Curl	**6 hours**
Sub module 6: Integration of vector valued functions • Line integrals - Work done by a variable force • Conservative forces • Double/surface integrals	**9 hours**
Mode of delivery This module will be taught by using lectures, demonstrations, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Vector Annalysis by S. Chand, 1st edition, 2008.
2. Engineering Mathematics by A.K Stroud, 4th edition, 1992.
3. Schaum series by Muarrary and Spiegel, June 1982.

DM 122: Physical Meteorology I – 45 Hours

Module Code and Name: DM 122 PHYSICAL METEOROLOGY I **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on the physical processes and phenomena within the earth's atmosphere. It involves the study of cloud physics, precipitation, atmospheric radiation, lightning, optical phenomena and weather modification.	
Learning outcomes By the end of the module, learners should be able to describe physical processes in the earth's atmosphere, explain the earth's energy budget and apply thermodynamic principles in meteorology.	
Competences The learner: • Describes physical phenomena in the atmosphere • Applies gas laws	
Detailed Module Description	**Duration**

Sub module 1: Introduction • Definition of key terms • Composition of the Atmosphere • The vertical Structure of the Atmosphere • Characteristics of atmospheric layers • Lapse rate and atmospheric stability	**5 hours**
Sub module 2: The Behaviour of Dry Air • The equation of the state of a perfect gas • The molar heat capacities • The molecular weight of dry air	**4 hours**
Sub module 3: Heat • Definitions • Heat transfer processes • Specific Heat of Gases • Gas laws • Laws of thermodynamics and their applications • Potential temperature and entropy	**5 hours**
Sub module 4: Cyclic processes • Work done in a closed loop • Expansion and compression of gases at constant temperature • Removal and addition of heat at constant volume • Adiabatic processes, $PV^{\gamma} = \text{Constant}$	**6 hours**
Sub module 5: Radiation in the Atmosphere • Energy budget • Radiation terms (radiance, emittance and equilibrium) • Electromagnetic spectrum • Radiation laws: Stefan-Boltzmann's Law, Plank's Law, Kirchhoff's Law, Wein's Displacement Law • Transmissions of electromagnetic waves in the atmosphere: Absorption, Refraction, Reflection, albedo and scattering • Dissociation and ionization	**10hours**
Sub module 6: Introduction to micrometeorology • Definition of key terms • Physical process and nature of airflow near the ground • Wind speeds over a uniform level surface - tropical wind profile over a uniform surface • Flow within a fluid boundary layer: turbulent-boundary layer flow over a smooth surface	**15 hours**

• Shear stress via the mixing length concept
• Interpretation of the mixing length concept
• The wind profile equation in complete form
• Influence of the surface roughness on the wind
  o Roughness in the aerodynamic sense
  o Roughness in relation to shear stress and mean wind speed
  o Change in surface roughness
• Vertical transport by turbulence
• Heat flux and related calculations
• Vertical temperature gradients in relation to turbulent flow.	

Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Dynamical and Physical Meteorology by George J. Haltiner and Frank L. Martin
2. Elements of Dynamic Meteorology by A.H. Gordon
3. An introduction to Atmospheric physics, Second Edition by David G. Andrews.

DM 123: Climate System and Analytics – 45 Hours

Module Code and Name: DM 123 CLIMATE SYSTEM AND ANALYTICS **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**
Module description This module is concerned with the study of climate, encompassing the analysis and understanding of long-term weather patterns, their variability, and how they interact within the climate system.
Learning outcomes By the end of this module, students should be able to classify climates, identify different socio-economic activities for a particular climate zone, explain climate system interactions and analyze climatological data for decision making.
Competences The learner: • Defines key terms • Relates weather and climate • Identifies climate controls • Describes air mass circulations

• Classifies climates	
Detailed Module Description	**Duration**
Sub module 1: Introduction to climatology • Definition of key terms; weather, Climate, climatology. • Relationship between weather and climate • Importance and application of climatology • Climate as a natural resource and hazard • Branches of climatology (urban climatology, paleo-climaotology, dynamic climatology) • Elements of Climate: solar radiation and sunshine, atmospheric temperature, atmospheric pressure, wind speed and direction, atmospheric humidity, cloud cover, precipitation, visibility • Climate system: atmosphere, biosphere, cryosphere, lithosphere, hydrosphere	**4hours**
Sub module 2: Weather and Climatic controls • Control factors of climate; natural and anthropogenic factors • The Earth-Sun relations: Associated terms; Rotation of the earth on its axis, revolution for the earth around the sun, tilting of the earth on its axis,	**9hours**
Sub module 3: Micro climatology • Local circulations (land & sea breezes, katabatic & anabatic wind systems, urban heat island), • Vertical stability of the atmosphere; atmospheric turbulence • Temperature inversions and their effects on atmospheric stability	**9hours**
Sub module 4: Global circulations • Circulation Theories; pressure cell theories; general circulation of the atmosphere (GCA) • Air masses and frontal systems – Formation, types, characteristics, associated weather and modifications • Planetary wind systems (trades, monsoons, westerlies, polar easterlies) • Planetary waves: Jetstream, ITCZ, ocean currents.	**9hours**
Sub module 5: Climate classification • Classification schemes; Thornthwaite, Koppen Climate classification, Glenn Thomas Trewartha. • Climatic regions and their characteristics • Climate of East Africa: climatic regions, factors that affect the climate of East Africa.	**9hours**

Sub module 6: Climate Data Analysis • Collection, quality control, and analysis of climatic data from weather stations, RADAR and satellites. • Climatological products; Dekadals, state of the climate products, research products, CLIMAT message. • Climate data analysis methods and tools; analysis software, computer systems, models.	**5 hours**
Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Time series analysis in Meteorology and Climatology by Claude Duchon, Robert Hale · 2011
2. Climatology, Fourth Edition by Robert V. Rohli, Anthony J. Vega · 2017
3. Climate: Causes and effects of Climate Change by Dana Desonie · 2008
4. C. Donald Ahrens · 2007, Essentials of Meteorology; An invitation to the Atmosphere
5. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.

DM 124: Synoptic Meteorology – 45 Hours

Module Code and Name: DM 124 SYNOPTIC METEOROLOGY **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**
Module description This module is concerned with analysis of weather data over large geographical areas observed at the same time. It further looks at forecasting, meso-scale to planetary scales weather systems as well as the development of these systems, their interactions and associated weather.
Learning outcomes At the end of the module, learners should be able to observe, plot and analyze weather data and use it to predict the future behavior of synoptic scale systems. The learner should also be able to diagnose the structure of synoptic scale weather systems.
Competences The learner: • Plots weather data

• Analyses weather data • Describes meso-scale weather systems	
Detailed Module Description	**Duration**
Sub module 1: Introduction • Overview of synoptic meteorology • Scales of weather systems • Network of Observatories; Surface, upper air; special observations (satellite, radar, aircraft.) • Review of weather observations • Review plotting of weather (surface and upper air)	**5 hours**
Sub module 2: The wind field • Trajectory, streamlines, Isotach, Isogon and contour analysis • Vertical wind structure • Zonal wind structure • The jet streams: definitions, types, structure, significance	**8 hours**
Sub module 3: The Pressure Field • The pressure systems – highs, lows, troughs, cols, ridges; • Pressure tendency • Filling, deepening, intensification and weakening as used in pressure systems • Isobaric analysis. The pressure-wind relation: Wind formation, geostrophic wind balance, gradient wind, and the thermal wind	**10 hours**
Sub module 4: Tropical Cyclone • Life cycle • vertical and horizontal structure of TC • movement and intensification. • Weather associated with TC. • Easterly wave and its structure and associated weather	**8 hours**
Sub module 5: Meso-scale meteorology • Sea and land breezes, • Mountain/valley winds, mountain wave • Thunderstorm and severe local storm (conditions favorable for thunderstorm, concepts of triggering mechanism, conditional instability; dust storm, hail storm. Squall, tornado, microburst/cloudburst)	**8 hours**
Sub module 5: Jet Streams • WMO definition of Jet stream, • Different jet streams around the globe, • Jet streams and weather	**6 hours**

Mode of delivery This module will be taught by using lectures, discussions, demonstrations and assignments.
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**

References

1. Djuric, D., 1994: Weather Analysis. Prentice Hall, 304 pp.
2. Holton, J.R., 2012, An Introduction to Dynamic Meteorology.5th edition., Academic Press 552pp.
3. Wallace, J.M and P. V. Hobbs, 2006: Atmospheric Science: An Introductory Survey. 2nd ed., Academic Press, 504 pp
4. Vasquez, Tim: Weather Map Handbook,2015 Weather Analysis & Forecasting Handbook.

DM 125: Remote Sensing – 45 Hours

Module Code and Name: DM 125 REMOTE SENSING **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on the art and science of acquiring remote data, use of the observations to infer the state of the earth's varied environment and its applications in meteorology, geography, aviation environmental science, urban planning, agriculture, and natural resource management among others.	
Learning outcomes At the end of this module, learners should be able to explain the principles and key components of remote sensing, identify appropriate remote sensing platforms and sensors for specific applications. Learners should also be able to interpret remote sensed imagery.	
Competences The learner: • Describes a remote sensing system • Applies radar, satellites in weather forecasting • Applies remotely sensed data in meteorology • Analyses remotely sensed data	
Detailed Module Description	**Duration**
Sub module 1: Introduction to remote sensing • Definitions	**5 hours**

• Elements measured by remote sensors • Components of remote sensing • Remote sensing system. • Types of remote sensing • Remote sensing platforms (ground based, air-based, space based) • Applications and limitations of remote sensing	
Sub module 2: Electromagnetic spectrum • Radiation laws; • Wave theory • EMR interaction with the atmosphere and the target and the sensor, radiative energy transfer. • Remote sensing windows • Spectral signatures	**10 hours**
Sub module 3: Remote sensing imagery • Types of images • Characteristics of images • visualization resolutions, • Image interpretation and classification.	**10 hours**
Sub module 4: Satellites meteorology • Types of satellites • compare operational differences between different types of satellites • Orbits & orbital parameters, and characteristics, • Applications and limitations of satellite and satellite sounding systems.	**10 hours**
Sub module 5: Radar meteorology • Definitions of key radar terms • Types of radars • principle of operation and • Radar equation and its application • Interpretation of radar imagery • application Radars and their limitations	**10 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Arthur P. Cracknell and L. Hayes (1991): Introduction to Remote Sensing, Taylor and Francis
2. James B. Campbell (2008): Introduction to Remote Sensing, Guilford Publications
3. Doviak R. J and Zrmic D. S., 1993: Doppler Radar and Weather Observations; Academic Press; 562 pp
4. Stephens G.L. 1994: Remote Sensing of the Lower Atmosphere; Oxford Univ. Press; 544 pp
5. Otto Huisman and Rolf A., de By (Eds.) 2009: Principles of Geographic Information Systems, (ITC Educational Textbook Series, 1).
6. Klaus Tempfli, Norman Merle, Gerrit C. Huurneman and Lucas L. F. Janssen (Eds.) 2009: Principles of Remote Sensing (ITC Educational Textbook Series, 2), Fourth edition.

DM 126: Research Methods - 45 Hours

Module Code and Name: DM 126 RESEARCH METHODS **Module level: YEAR I, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on the knowledge, skills, approaches and tools leaners need to conduct research.	
Learning outcomes By the end of the module, the learner should be able to identify a research problem, develop research objectives and questions/ hypothesis, identify and apply appropriate research method, apply research ethics, collect, organize, and analyze data using appropriate methods and software. The learner should as well be able to Interpret, evaluate and present research findings in form of a written research report.	
Competences The learner: • Identifies a research problem • Develops research objectives • Applies appropriate methodology to do research • Collects, organizes, and analyzes research data • Interprets, evaluates research findings • Writes a research report	
Detailed Module Description	**Duration**
Sub module 1: Introduction to Research Methods • Importance of research methods in various fields • Types of research • Ethical considerations in research • Research process	**5 hours**

Sub module 2: Research Design • Formulating research objectives and questions/ hypotheses • Types of research designs (experimental, correlational, descriptive.) • Sampling techniques (Probability and non-probability) • Determination of sample size • Validity and reliability	**8 hours**
Sub module 3: Data Collection Methods • Surveys and questionnaires • Interviews (structured, semi-structured, unstructured) • Observations (participant and non-participant) • Document analysis • Case studies	**8 hours**
Sub module 4: Data Analysis • Quantitative data analysis techniques (descriptive statistics, inferential statistics) • Qualitative data analysis techniques (thematic analysis, content analysis) • Data coding and interpretation • Use of statistical software (SPSS, R)	**12 hours**
Sub module 5: Research Ethics: • Ethical considerations in research (informed consent, confidentiality, minimizing harm) • Institutional review boards (IRBs) and ethics approval process • Ethical challenges and dilemmas in research	**6 hours**
Sub module 6: Writing and Presenting Research: • Structure and components of a research proposal/paper. • Writing literature reviews and methodology sections • Effective data visualization • Presenting research findings in oral and written formats • Referencing styles (e.g., APA 7th edition) and tools	**6 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Lyman R. and Michael T. (Edition 2000), An Introduction to Statistical Methods and Data Analyses,5Th Edition, Duxbury Press

2. Ronald E. Walpole, 3Rd Edition (1982), Introduction to Statistics.
3. Collins K.J et al 9th Edition (2000), Research in the Social Sciences
4. Stephen Polgar/share A. Thomas (1999), Introduction to Research in the health sciences
5. Murray R. Spiegel and Larry J.S (2008), Theory and Problems of Statistics, 4th Edition, McGraw – Hill.
6. Gregory S (1968), Statistical Methods and the Geographer, 2nd Edition.

DM127: Principles of Geographic Information Systems (GIS)

Module Code and Name: DM127 PRINCIPLES OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) **Module level: YEAR I, SEMESTER II** **Module Credit: 4CU**	
Module description This module focuses on introducing the learners to the basic concepts of GIS and its applications in meteorology.	
Learning outcomes At the end of this module, learners should be able to explain basic concepts of GIS, use Vector, Raster and meta datasets, import and populate the GIS's system to access spatial and attribute data, capture and manage spatial data, convert geographic information among several coordinate systems, create maps.	
Competences The learner: • Defines GIS • Identifies GIS components and software • Captures geographical data • Enters data in GIS • Visualizes data • Digitize data	
Detailed Module Description	**Duration**
Sub module 1: Introduction to Geographic Information Systems (GIS) • An overview of GIS (Definition, software and evolution) • Components of GIS (Hardware, software, data, Human) • Characteristics of geographical data • Applications of GIS	**10 hours**

• GIS Data Types- (Vector & Raster)	
Sub module 2: GIS Data Sources and Data Acquisition • GIS data sources (primary and secondary) • Creation of meta data and its importance) • Coordinate system and projection (Geographic coordinate system, Projected coordinate systems and Geometric transformation) • Global Positioning System (GPS) and its applications • Data digitalization	**15 hours**
Sub module 3: Data Visualization and cartography a) Cartographic representation b) Types of quantitative maps c) Map design, production and interpretation	**15 hours**
Sub module 4: Geographic Information Systems Analysis **(a) Vector Data analysis** • Clipping • Buffering • Overlay • Distance measurement **(b) Raster Data Analysis** • Spatial interpolation	**20 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Heywood,I, Cornelius, S. and S. Carcer, 2006 (3rd Edition); An introduction to Geographical Information Systems (Prentice-Hall)
2. Longley, PA, et al, 2005 (2nd Edition), Geographical Information Systems ans Science (Chichester: John Wiley and Sons Ltd)
3. Geographic Information Systems and Science, Second Edition, Paul Longley, Michael Goodchild, David Maguire, David Rhind, John Wiley and Sons, 2005

YEAR TWO, 1ST SEMESTER

DM 211: Tropical Meteorology – 45 Hours

Module Code and Name: DM 211 TROPICAL METEOROLOGY **Module level: YEAR II, SEMESTER I** **Module Credit: 3CU**	
Module description This module focuses on weather and climate in the tropics. It describes the large-scale circulation systems of the tropical atmosphere and analyses the dynamics and energetics of such systems. It also provides students with a better understanding of the meteorological processes in the tropics as well as the origins and evolution of equatorial disturbances and easterly waves, the structure and dynamics of tropical cyclones, prediction and interact to cause weather and climate in the tropics.	
Learning outcomes By the end of this module, the leaner should be able to explain the dynamics and thermodynamics of the tropical atmosphere, the structure, development, and evolution of various tropical phenomena, describe the circulation and radiative processes of the tropical atmosphere and analyze and forecast tropical phenomena.	
Competences The learner: • Describes circulations in the tropics • analyses the dynamics and energetics of such systems • explains tropical disturbances and associated weather	
Detailed Module Description	**Duration**
Sub module 1: Introduction to Tropical Meteorology • Overview of tropical regions and their climatic characteristics • Tropical meteorology vs. mid-latitude meteorology • Importance of studying tropical weather patterns • Scales of atmospheric motion in the tropics • The role of the tropics in the global energy and momentum balance • Role of the tropics in global weather and climate systems • Seasonal and geographic distribution and the diurnal cycle of surface temperature and the influencing factors.	**5 hours**

Sub module 2: Tropical weather systems • Tropical convection • Thunderstorms and Squalls • General circulation of the Tropics; Sub-Tropical Highs, Equatorial Lows, The Inter-Tropical Convergence Zone (ITCZ), migration and associated weather. • The Monsoons: Types of monsoon systems (East African, West African and Indian monsoons); Definition and characteristics of monsoons; Monsoon circulation and its seasonal variations; Monsoon rainfall patterns and variability; Socioeconomic impacts of monsoons on agriculture, water resources, and human settlements	**10 hours**
Sub module 3: Precipitation Patterns in the Tropics • Types of tropical rainfall (convective, stratiform, orographic) • Mechanisms and factors influencing tropical precipitation • Rainfall variability and extreme events in tropical regions • Tropical rainforests and their role in regional and global climate systems	**10hours**
Sub module 4: Tropical Cyclones • Definition • Easterly waves • Structure and formation of tropical cyclones • Development, dynamics and climatology of tropical cyclones • Associated weather • Tropical cyclone tracking and forecasting • Impacts of tropical cyclones on the environment and socio-economic development • Tropical cyclone preparedness and mitigation strategies	**10hours**
Sub module 5: Tropical Circulations and oscillations • Hadley Cell and Walker circulations and their role in tropical weather patterns • Trade winds and their influence on surface currents and climate • El Niño-Southern Oscillation (ENSO) and its effects on tropical climate variability • Madden-Julien Oscillation (MJO) • Indian ocean dipole (IOD) • Ocean currents • Effect of tropical circulations on Climate variability in the Tropics	**10 hours**
Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.	

Assessment

This module will be examined through continuous and final assessment as follows

Continuous assessment: 40% (Assignments 15% and Tests 25%)

Final Assessment: 60%

Total 100%

References:

1. Thomas Ahrens, Donald C. Ahrens · 1993, Essentials of Meteorology; An invitation to the Atmosphere
2. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.
3. Asnani, G. C., (1993): Tropical Meteorology, volume 2, Pune press
4. James R. Holton (2004): Introduction to Dynamic Meteorology, third edition, Academic press.
5. Galvin, J. F. P., (2016): An introduction to the meteorology and climate of the tropics
6. Introduction to Circulating Atmospheres, I. N. James (Cambridge 1994)
7. Atmospheric Convection, K. A. Emanuel(Oxford, 1994)
8. El Niño, La Niña and the Southern Oscillation, S. G. Philander (Academic Press, 1990)
9. Global Perspectives on Tropical Cyclones: From Science to Mitigation, [J. C. L. Chan and J. Kepert (eds.)]. (World Scientific Publishing Company, 2010)

DM 212: Dynamic Meteorology I – 45 Hours

Module Code and Name: DM 212: DYNAMIC METEOROLOGY I
Module level: YEAR II, SEMESTER I
Module Credit: 3CU

Module description

This module focuses on the fundamentals of fluid dynamics necessary for understanding large-scale atmospheric motions. It looks at the development, derivation, and analysis of the laws of conservation of mass, momentum, and energy, as they apply to weather and climate systems.

Learning outcomes

By the end of this module, learners should be able to explain and apply the conservation laws of energy, mass, water vapor in forecasting weather and climate.

Competences

The learner:

- Explains different atmospheric forces
- Derives equations for conservation laws of mass, momentum, and energy
- Applies these laws to understand evolution and development of weather systems

Detailed Module Description	Duration
Sub module 1: Introduction • Definition of terms • Physical Dimensions and units • Scope of dynamic meteorology • Scale analysis: Meaning of scale analysis or scaling, Uses of scale analysis, Characteristic horizontal length of atmospheric motions (molecular motion, eddies, gusts, gale, squall, tropical storm)	**8 hours**
Sub module 2: Atmospheric forces • Fundamental forces: gravitational, frictional, and pressure gradient force, • Non-inertial frames of reference and apparent forces: centripetal/centrifugal force, Coriolis force • Structure of a static atmosphere	**12 hours**
Sub module 3: Basic Conservation laws • Total differentiation • Vectorial form of the momentum equation in rotating coordinates • Component equations in spherical coordinates • The continuity equation: Eulerian and Lagragian derivation, scale analysis of the continuity equation. • Thermodynamic energy equations • Thermodynamics of dry atmosphere	**15 hours**
Sub module 4: Coordinate Transformation • Rotating coordinates, components, equation in horizontal motion • Equation of horizontal frictionless motion in Cartesian coordinates • Component equation in (x,y,z,t)	**10 hours**
Mode of delivery This module will be taught by using lectures, demonstrations, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Dynamical and Physical Meteorology by George J. Haltiner, Frank Lionel Martin · 1957

2. Dynamic Meteorology by Jörgen Holmboe, George Elmer Forsythe, William Sharp Gustin · 1945
3. Introduction to Dynamic Meteorology, F. Panofsky, Penn State Press, 1956.
4. Introduction to Dynamic Meteorology by James R. Holton · 2004
5. Elements of Dynamic Meteorology A.H. Gordon, 1962
6. An introduction to Atmospheric physics, Second Edition by David G. Andrews · 2010

DM 213: Physical Meteorology II – 45 Hours

Module Code and Name: DM 213 PHYSICAL METEOROLOGY II **Module level: YEAR II, SEMESTER I** **Module Credit: 3CU**	
Module description This module focuses on physical properties of moist air in the earth's atmosphere.	
Learning outcomes By the end of this module, the learner should be able to explain atmospheric stability, describe the physics of clouds, cloud seeding, lightning as well as plot and interpret a tephigram	
Competences The learner: • Explains atmospheric stability and instability • Describes cloud development mechanism • Plots and analyses a tephigram • Explains atmospheric electricity	
Detailed Module Description	**Duration**
Sub module 1: The Behaviour of Moist Air • Water phases and changes • Latent heat • Equation of state of water vapour • Clausious -Clyperon Equation and its implication • Moist Air parameters: Vapour Pressure (e), mixing ratio, (r), specific humidity (s), and relative humidity (RH), Pseudo-adiabatic process, critical temperature (T_c) and Hygrometric Equation.	**12hours**
Sub module 2: Hydrostatic Equilibrium • Hydrostatic Equation • Geo potential height • Barometric Equation for Constant Lapse Rate • Pressure in a fluid at rest • Thickness of an atmospheric layer • Reduction of pressure to mean sea level	**15 hours**

• Stability and instability: adiabatic Lapse Rates, equilibrium conditions, the parcel method and applications • Thermodynamic and phase diagrams; Plotting and interpretation of a Tephigram.	
Sub module 3: Cloud Physics • Cloud formation • Types of clouds; classification • Precipitation mechanisms; Charge generation; nucleation. • Cloud seeding and artificial rain making.	**8 hours**
Sub module 4: Atmospheric Electricity, Acoustical and Optical phenomena • Charges, Lightning formation, types of lightning • Dangers or hazards (Thunder, Lightning, hail, strong winds) and Safety measures • Thunderstorm formation and Photo-meteors (corona, halo, rainbow)	**10 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Dynamical and Physical Meteorology by George J. Haltiner and Frank L. Martin
2. Elements of Dynamic Meteorology by A.H. Gordon
3. James R. Holton: Introduction to Dynamic Meteorology
4. Thomas Ahrens, Donald C. Ahrens · 1993, Essentials of Meteorology; An invitation to the Atmosphere
5. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.

An introduction to Atmospheric physics, Second Edition by David G. Andrews.

DM 214: Agrometeorology – 60 Hours

Module Code and Name: DM 214 AGROMETEOROLOGY **Module level: YEAR II, SEMESTER I** **Module Credit: 4CU**

Module description

This module focuses on the application of weather and climate information in agriculture with a purpose of increasing crop and animal production.

Learning outcomes

By the end of this module, learners should be able to relate weather and climate to agriculture, examine the importance of weather and climate to agriculture and appropriately use weather and climate information to boost agricultural productivity.

Competences

The learner:

- Relates weather and climate to agriculture
- Examines importance of weather and climate to agriculture

Detailed Module Description	**Duration**
Sub module 1: Introduction • Overview of agrometeorology • Influence of weather and climate on agriculture • Agricultural operations sensitive to climate and weather • Weather and climate, harvesting and post-harvest handling	**4 hours**
Sub module 2: Radiation, temperature and plant growth and development • Photosynthesis versus net photosynthesis • Transport, diffusion and osmosis • Surface energy balance and temperature measurement • Bowen ratio and its applications in agriculture • Classes of crops (horticultural crops, annuals and perenials) • Plant, animal and temperature relationship • Importance of soil temperature to crop production • Soil's thermal regime and its modification • Cardinal temperatures • Thermal effects of environment on plant and animal growth and development • Periodism (Thermoperiodism, Photoperiodism)	**6 hours**
Sub module 3: Phenology • Phenological observations in plants and animals • Phenological Phases • Applications of phenological data	**6 hours**

• Selection of fields for phenological observations (Row grown crops, crops with continuous surface, perennial trees and bushes) • Monthly phenological reports for annual crops and perennial plants • Factors affecting phenology of different plants, • Observations of the state of the crops and animals; • General assessment on the state of the crops and animals (damage from adverse • Marks for assessment	
Sub module 4: Soil • Definition of terms • Soil composition • Soil forming processes • Soil classification • Soil type distribution • Physical Soil properties • Chemical Soil properties • Biological Soil properties • Soil moisture, importance, classification, measurement and control factors • Infiltration (definitions, measurement, control factors), • Runoff (definition, types, influencing factors) • Soil degradation • Soil conservation.	**12 hours**
Sub module 5: Evapotranspiration (ET) • Definitions (Actual ET and potential ET) • Control factors for ET • Measurements of ET • Importance to agriculture • Crop water needs	**6 hours**
Sub module 6: Pests and parasites • Types of pests and parasites • Features that make insect pests and parasites survive in the environment • Damages caused by pests and parasites • Effects of weather and climate on survival of pests and parasites • Agrometeorological aspects of protection against insect pests	**6 hours**
Sub module 7: Crop and animal diseases • Types of diseases • Causes of disease • Signs and symptoms • Effects of diseases on crop and animal production	**6 hours**

• Methods of controlling diseases	
Sub module 8: Weeds • Types of weeds • Importance of weeds • Effects of weeds • Methods of weed control	**6 hours**
Sub module 9: Climate Smart Agriculture (CSA) • Overview; Definitions of terms and Objectives, pillars and principles of CSA • CSA practices • Application of CSA in pest and disease management • Opportunities, Challenges and remedies of CSA implementation.	**8 hours**
Mode of delivery This module will be taught by using lectures, experiments, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Harpal Singh Mavi and Graeme J. Tupper (2004) Agrometeorology; Principals and Appliance of Climate Studies in Agric. Haworth Press Inc. NY.
2. Jackson I. J (1963): Agricultural Met. Part, Israel Programme for Scientific Translation, Jerusalem.
3. WMO Lecture notes for Training Class IV Agricultural Met Personnel WMO No. 593 (issued 1985)
4. Hamlyn G. Jones · 1992, Plants and microclimate A quantitative approach to environmental plant physiology, Second edition .
5. Guide to Agricultural Meteorological Practices(WMO,1981)
6. Harpal S. Mavi, Graeme J. Tupper · 2004, MAgSc, DipEd Agrometeorology Principles and Applications of Climate Studies in Agriculture

DM 215: Climate change, mitigation and adaptation strategies – 60 Hours

Module Code and Name: DM 215 CLIMATE CHANGE, MITIGATION AND ADAPTATION STRATEGIES **Module level: YEAR II, SEMESTER I**

Module Credit: 4CU

Module description

This module focuses on a broad understanding of the topics in climate change, ranging from the historical perspective, scientific basis, observations, impacts, adaptation, mitigation and policy issues among others.

Learning outcomes

By the end of this module, learners should be able to define climate change and climate variability, their manifestation, explain the cause, socioeconomic impacts and suggest mitigation and adaptation strategies to address them. The learner should also be able to evaluate the existing national, regional and international efforts in place to address climate change.

Competences

The learner:

- Defines key terms and concepts
- Identifies different extreme weather and climate events
- Explains how climate change impact different sectors
- Evaluates existing legal frameworks to address climate change

Detailed Module Description	**Duration**
Sub module 1: Climate change science • Climate Change (definitions, modes of climate change, History of climate change) • Differences between climate change and climate variability • Climate change study of past/paleo, recent and future (Modeling and Projections) • Evidence of climate change • Drivers of climate change (IOD, ENSO, MJO) • Climate forcings and feedbacks • Greenhouse effect and global warming, Impact (positive and negative), mitigation and adaptation strategies, limitations.	**10Hours**
Sub module 2: Climate sensitivity and feedback mechanisms • Climate response • Climate feedback process (positive & negatives) • Climate sensitivity and feedback parameter	**6 hours**
Sub module 3: Extreme climate and weather events • Definitions (Risk, hazard, disaster, vulnerability, resilience and adaptive Capacity)	**16 hours**

• Classification of hazards • Drought (definition, types, Drought indices, Drought early warning systems, Socioeconomic impacts, adaptation strategies, limitations • Mass movement (types, area of occurrence in Uganda, Early warning systems, Socioeconomic impacts, adaptation strategies, limitations) • Floods; definition, area of occurrence in Uganda, Early warning systems, Socioeconomic impacts, adaptation strategies, limitations • Frost, Hail; and their suppression	
Sub module 4: climate change mitigation and adaptation strategies (highlighting national policies at sector level) • Agricultural • Housing • Tourism • Water sector	**8 hours**
Sub module 5: Climate change conventions and policies • Global (Kyoto Protocol, Montreal protocol, Doha Accord, COP21, IPCC - Inter-Governmental panel of Climate Change, UNFCCC – United Nations framework on Climate Change Convention, GCFS – Global Climate Framework Services, SDGs) • Regional; role of regional bodies ICPAC, IGAD, ACAMAD • National; role of MWE, UNMA, NFA, NEMA, NDP III, NAP, NAPA	**20 hours**
Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. IPCC reports (AR4,5 &6)
2. IPCC (2013). Climate Change 2013. The Physical Science Basis -Summary for Policymakers
3. UNEP (2009). Climate Change Science Compendium
4. Houghton, D. David., (2002): Introduction to Climate Change, Lecture notes for meteorologists, WMO-No. 926
5. C. Donald Ahrens · 2007, Essentials of Meteorology; An invitation to the Atmosphere

DM 216: Environmental Pollution and Control – 45 Hours

Module Code and Name: DM 216 ENVIRONMENTAL POLLUTION AND CONTROL
Module level: YEAR II, SEMESTER I
Module Credit: 3CU

Module description

- This module introduces learners to evolution of the earth's atmosphere, chemical components and reactions, and how changes in these affect climate, human health, and ecosystems.

Learning outcomes

By the end of this module, learners should be able to explain the evolution of the earth's atmosphere, describe the earth's atmospheric chemical composition and transformations of compounds, describe different air pollutants; source, impact to the climate, human health, and ecosystem health. The leaner should also be able to evaluate the existing legal frameworks to address air pollution.

Competences

The learner:

- Explains different forms of environmental pollution
- Discuses impacts of pollution to the environment
- Devises strategies to mitigate the challenge

Detailed Module Description	**Duration**
1. **Sub module 1:** Earth's Atmosphere • Recap of Earth's Atmosphere • Evolution of the Earth's Atmosphere • Composition and Structure earth's Atmosphere	**4 Hours**
Sub module 2: Fundamental Chemistry Concepts • Structure of an atom; • The periodic table; • Compounds; valency; bonds; • Acids and bases; inert gases; • Metals and non-metals: Reactions and reaction rates	**10 hours**
Sub module 3: Air pollution: • Causes of air pollution: Natural and anthropogenic • Major Air Pollutants: carbon oxides, Nitrogen oxides, Sulphur Oxides, dust, fumes, photochemical smog, • Atmospheric aerosols: Definition, classification and their significance. • Pollutant Dispersal: weather and stability conditions of the atmosphere • Air pollution Measurement and monitoring • Impacts of air pollution on the environment • Greenhouse effect and global warming: Greenhouse gases and sources • Urban heat island (UHI)	**15 hours**

Sub module 4: Noise pollution • Definition • Sources • Environmental impacts and mitigation measures	**4 hours**
2. **Sub module 5:** Waste and its management • Definition • Classification of waste • Economics of wastes • Waste management and disposal	**6 hours**
Sub module 6: Air pollution Management and regulations • Control of air pollution. • Policies and Regulations: o Globally – UNFCCC, IPCC, COP3, DOHA accord o Regionally – EAC, ICPAC, ACMAD o Nationally - NEMA, NFA, UNMA, CSOs, NGOs, CBOs	**6 hours**
Mode of delivery This module will be taught by using lectures, discussions, field studies and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Daniel A. Vallero (2008). Fundamentals of Air Pollution, Academic Press
2. Daniel Vallero, Fundamentals of Air Pollution. 4th Edition, Academic Press, Burlington, MA, 2008.
3. Thad Godish, Air Quality, 4th Edition, Lewis Publishers, 2003
4. Mark Z. Jacobson, Cambridge University Press, Cambridge, 2002, Atmospheric Pollution: History, Science, and Regulation
5. Air Pollution and Health, S.H. Holgate, J.M. Samet, H.S. Koren, and R.L. Maynard, Eds., Academic Press, 1999.
6. Daniel J. Jacob, Introduction to Atmospheric Chemistry, 1999, Princeton University Press.
7. J. Jeffrey Pierce, Ruth F. Weiner, P. Aarne Vesilind (1998): Environment Pollution and Control, Bultermorth – Heinemann.
8. Atmospheric Chemistry and Physics, by John Seinfeld and Spyros Pandis, John Wiley & Sons, 1997

DM 217: Entrepreneurship Skills – 45 Hours

Module Code and Name: DM 217 ENTREPRENEURSHIP SKILLS **Module level: YEAR II, SEMESTER I** **Module Credit: 3CU**	
Module description This module is focuses on acquainting learners with entrepreneurship knowledge, skills and attitudes.	
Learning outcomes By the end of this module, learners should be able to prepare effective business plans, identify resources to start up business ventures, demonstrate ability to work in a team, run a business and also manage business challenges involved in production, marketing and sales of goods and services.	
Competences The learner: • Prepares effective business plans • Starts up business venture • Markets and sales goods and services	
Detailed Module Description	**Duration**
Sub module 1: INTRODUCTION • Concepts of entrepreneurship • Entrepreneurship process • Integrative model of entrenuership • Roles of entrepreneurship in an economy	**5 hours**
Submodule: APPLICATIONS OF ENTREPRENEURSHIP • A business career • Business communication • Negotiation • Innovation • Creativity • Risk in business.	**5 hours**
Sub module 3: FORMS OF ENTERPRISES • Micro enterprises • Small enterprises • Medium enterprises	**5 hours**

Sub module 4: BUSINESS PLAN • Components of business plan • Nature of successful business plan • Business model to business plan. • Issues of business failures.	**5 hours**
Sub module 5: TYPES OF ENTREPRENEURS • Entrepenurer • Intrenprenuer • Enterprising person	**5 hours**
Sub module 6: BUSINESS IDEAS • Ways of generating business ideas, sources and types of ideas. • Evaluating the idea • Factors undemanding the idea.	**5 hours**

Sub module 7: FINANCE AND ACCOUNTING
• Sources of finance
• Reasons for financing ventures
• Types of costs
• Financial statements
  o Income statement
  o Statement of cash flows
  o Statement of financial position (balance sheet)
	5 hours

Sub module 8: MARKETING MANAGEMENT • Marketing evolution in start ups • Marketing mix. • Setting prices	**5 hours**
Sub module 9: BUSINESS ETHICS • Nature of ethics • Unique ethical challenges in entrepreneurship • Ethical reference points • Creating an ethical business environment.	**5 hours**
Mode of delivery This module will be taught by using lectures, discussions, field visits and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Ssempijja M (2013) new entrepreneurship education for A level and business institutions - revised edition
2. Wasswa Balunywa (2003) Entrepreneurship Development in Uganda
3. NCDC (2010) Entrepreneurship Education Teachers' Guide for A 'level, book 6
4. Sebunya K (2003) doors of opportunity

DM 218: Statistical Software for data analysis – 45 Hours

Module Code and Name: DM 218 STATISTICAL SOFTWARE FOR DATA ANALYSIS **Module level: YEAR II, SEMESTER I** **Module Credit: 3 CU**	
Module description This module is designed to provide students with an understanding of the different Statistical Software, their evolution and relevancy. Such packages include STATA, R, MATLAB, SPSS, CPT and PYTHON so on. After the general overview, then emphasis will be put on the Statistical Package for the Social Sciences (SPSS). The overview of SPSS and its interface, familiarizing learners with the software's features and functionalities. Leaners will import, manage, and clean data within SPSS, ensuring data quality and reliability. Exploratory data analysis techniques will be covered, including descriptive statistics, data visualization, and basic data manipulation. Students will learn how to perform inferential statistics, including hypothesis testing, t-tests, chi-square tests, and ANOVA (analysis of variance). They will also explore correlation and regression analysis, both simple and multiple, to understand relationships and make predictions based on data. They will also how to create charts, graphs, and tables to effectively present data and interpret the results of their analyses.	
Learning outcomes By the end of this module, learners should be able to use SPSS to import, manage, analyze, and visualize data, making them proficient in utilizing software for research and decision-making purposes.	
Competences The learner: • Imports data • Manages data • Analyzes data • Visualizes data	
Detailed Module Description	**Duration**
Sub module 1: Introduction to SPSS • Overview of SPSS and its features • Understanding the SPSS interface and data editor	**5 hours**

• Opening, saving, and managing SPSS data files • Working with data view and variable view • Basic data manipulation techniques (e.g., recoding, computing new variables)	
Sub module 2: Data Import and Cleaning • Importing data from various file formats (e.g., Excel, CSV) • Checking data quality and identifying missing values • Handling outliers and data errors • Cleaning and transforming data for analysis	**6 hours**
Sub module 3: Descriptive Statistics and Data Visualization • Computing measures of central tendency (mean, median, mode) • Calculating measures of dispersion (variance, standard deviation) • Creating frequency distributions and histograms • Generating charts, graphs, and tables for data visualization	**6 hours**
Sub module 4: Inferential Statistics and Hypothesis Testing • Understanding hypothesis testing concepts • Performing t-tests for independent and dependent samples • Conducting chi-square tests for categorical data • Interpreting p-values and confidence intervals	**6 hours**
Sub module 5: Analysis of Variance (ANOVA) • Introduction to ANOVA and its applications • Performing one-way ANOVA for multiple groups • Post-hoc tests and multiple comparisons • Interpreting ANOVA results and effect sizes	**8 hours**
Sub module 6: Correlation Analysis • Understanding correlation coefficients and their interpretations • Computing Pearson's correlation coefficient • Interpreting correlation matrices • Exploring the relationship between variables using scatterplots	**4 hours**
Sub module 7: Regression Analysis • Introduction to regression analysis • Performing simple linear regression • Multiple regression analysis and model building • Evaluating regression models and interpreting results	**4 hours**
Sub module 8: Data Reporting and Presentation • Formatting output and creating comprehensive reports • Creating professional charts, graphs, and tables for presentations • Effectively communicating statistical results and findings • Ethical considerations in data reporting and presentation	**6 hours**

Mode of delivery This module will be taught by using lectures and practical tasks
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**

References:

YEAR TWO, 2ND SEMESTER

DM 221: Dynamic Meteorology II – 45 Hours

Module Code and Name: DM 221 DYNAMIC METEOROLOGY II **Module level: YEAR II, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on the application of the complete momentum equation, circulation, vorticity and Numerical Weather Prediction.	
Learning outcomes By the end of this module, learners should be able to explain balanced wind flow in the atmosphere, the concepts of circulation and vorticity, identify primitive equations, apply them in Numerical Weather predictions (NWP) for short, medium and long-range forecasting.	
Competences The learner: • Simplifies equations of motion through scale analysis to deduce different motion types • Explains the concepts of Circulation and Vorticity and how they relate to meteorological phenomena • Explains basic concepts NWP and its application in meteorology	
Detailed Module Description	**Duration**
Sub module 1: Scale analysis of the equations of motion. • Mesoscale and Synoptic scale, Geostrophic approximations and geostrophic wind • Approximate prognostic equations – Rossby number R and its importance in meteorology, • Hydrostatic approximations	**8 hours**

Sub module 2: Elementary applications of the basic equations. • Momentum equation in Cartesian and spherical/polar coordinates • Basic equations in isobaric coordinates: horizontal momentum equation, continuity equation, thermodynamic equation • Balanced flow: Natural coordinates, geostrophic flow - Geostrophic wind when pressure is used as vertical coordinates, inertial flow, cyclostrophic flow, gradient wind approximations (Cyclonic and anti-cyclonic flow), Isentropic coordinates (geopotential) • Flow along parallel circular isobars – the gradient wind, • Thermal wind: veering and backing, baroclinic and barotropic atmosphere • Vertical motion: Kinematic methods and adiabatic methods	**20 hours**
Sub module 3: Circulation and Vorticity. • Circulation theorem: • Absolute, Relative, and Potential vorticity • Vorticity equations • Vorticity Conservation equation • Vorticity: vorticity in natural coordinates, Potential vorticity • Vorticity in a barotropic fluids • Baroclinic Potential Vorticity equation	**13 hours**
Sub module 4: Numerical Weather Prediction (NWP). • Meaning, Application, Atmospheric Weather Model Elements. • Forward and backward difference approximation	**4 hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. James R. Holton: Introduction to Dynamic Meteorology, 5th Edition, 2012
2. George J. Haltiner and Frank L. Martin: Dynamical and Physical Meteorology
3. Thomas Ahrens, Donald C. Ahrens · 1993, Essentials of Meteorology; An invitation to the Atmosphere
4. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.

5. An introduction to Atmospheric physics, Second Edition by David G. Andrews.

DM222: Aviation Meteorology – 45 Hours

Module Code and Name: DM222 AVIATION METEOROLOGY **Module level: YEAR II, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on understanding the physical properties of the atmosphere and how these affect aviation operations to enable evidence based decision making for safe air navigation.	
Learning outcomes By the end of this module, learners should be able to interpret the aviation weather codes, monitor and analyze the weather and forecast aeronautical meteorological phenomena. The learner should also be able to Prepare aviation weather reports and also Communicate meteorological information to the users considerate of the Quality Management Systems principles.	
Competences The learner: • Identifies aviation weather hazards • Prepares aviation weather reports • Interprets aviation weather reports • Explains different standards required in aviation industry	
Detailed Module Description	**Duration**
1. Sub module1: Introduction • Definitions • The atmosphere (temperature and pressure profile, atmospheric stability) • The International Standard Atmosphere (ISA) and Altimetry, o The altimeter, o Q – codes (QNH, QFE, QFF), o Temperature and density.	**8hours**
Sub module 2: Aviation weather hazards • Visibility, • Fog and mist, • Wind shear and turbulence, • Thunderstorm; tornadoes and squall lines, cloud ceiling and precipitation, • Weather fronts and associated weather, • Jet streams, • Icing,	**10 hours**

• Accident investigation case study approach	
Sub module 3: Forecasts • Types of aeronautical meteorological forecasts; Aerodrome forecasts (TAF), • Trend forecasts, • Take -off forecasts • En-route forecasts	**3 hours**
Sub module 4: Aerodrome reports • Routine reports (METAR)/Special reports (SPECI) • Reports of volcanic activity • SIGMET information, • Tropical cyclone and volcanic ash advisory information, • AIRMET information, • Aerodrome warnings and wind shear warnings and alerts	**8 hours**
Sub module 5: Meteorological service for operators and flight crew members • Flight operations (flight planning and briefing) • Flight documentation, • Automated pre-flight information systems, • Information for aircraft in flight.	**4 hours**
Sub module 6: Meteorological service for international air navigation • World Meteorological Organization (WMO), • International Civil Aviation Organisation (ICAO) and International Air Transport Association (IATA) Procedures, • Aerodrome meteorological offices and other meteorological offices, • Meteorological watch offices (MWOs), • Aeronautical meteorological stations, • World area forecast centers (WAFCs); Tropical cyclone advisory centers (TCACs); Volcanic ash advisory centers, State volcano observatories, • Air traffic control (ATC) services, • Search and rescue services, • Specific local requirements by aviation users for meteorological services. • Aviation telecommunication: (AFTN and ATN)	**8 hours**
Sub module 7: Quality Management System (QMS) for aeronautical meteorological services • Introduction to QMS (principles and importance of QMS)	**4 hours**

• Risk management • Statutory and regulation requirements for aeronautical meteorological service	
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. ICAO, Doc 8896, Manual of Aeronautical Meteorological Practice, Eleventh Edition, 2017.
2. Twentieth Edition, July 2018.
3. Thomas Ahrens, Donald C. Ahrens · 1993, Essentials of Meteorology; An invitation to the Atmosphere
4. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.

DM 222: Principles of Weather Forecasting – 60 Hours

Module Code and Name: DM 222 PRINCIPLES OF WEATHER FORECASTING **Module level: YEAR II, SEMESTER II** **Module Credit: 4CU**	
Module description This module focuses on the analysis of weather charts and use of other various methods to track the evolution of weather systems to be able to forecast weather.	
Learning outcomes By the end of this module, learners should be able to plot, interpret station plots of surface and upper-air weather data. The leaner should also be able to analyze surface weather and upper air weather charts for purposes of forecasting weather plus its verification.	
Competences The learner: • Plots weather on charts • Analyzes weather using different charts • Tracks weather systems • Forecasts weather	
Detailed Module Description	**Duration**

Sub module 1: Introduction • Base map and projections • Data display; identifications of weather symbols on weather charts, station plotting models • Recap of Plotting and Decoding of station plots	**5 hours**
Sub module 2: Weather Forecasting • Definition • Forecasting ranges (nowcast, short, medium and long) • Forecast Tools (METAR, Synop, Weather summaries, analyzed weather charts-surface and upper level, Model output, Meteogram, TephiGram, satellite imageries, Radar imageries) • Forecast process (diagnosis, analysis and prognosis) • Forecasting Methods (Persistence, trend, climatology, analog, Numerical Weather Prediction, Indigenous knowledge) • Forecast generation and dissemination • Application of weather forecasts	**15 Hours**
Sub module 3: Weather Chart Analysis • Basic analysis principle requirements and procedures (dynamical and hemispheric considerations) • Surface weather chart analysis (1000mb) and Technological regulations; weather analysis, isotherm analysis, isobaric analysis, isallobaric analysis, • Upper air weather chart analysis and Technological regulations (Contour analysis for constant pressure level charts – 850mb, 700mb, 500mb, 300mb, 200mb, 100mb) • Streamlines analysis (Asymptotes, Convergence, Divergence and Vorticity) • TephiGram (data used, plotting, analysis and applications in weather forecasting) • Mid latitude and high latitude weather system analysis; Primary analysis of fronts; Distributions of meteorological elements near fronts and principle of determining fronts. • Tropical weather analysis (Easterly waves, ITCZ, Tropical cyclones, subtropical highs, MJO, IOD, ENSO)	**40 Hours**
Mode of delivery This module will be taught by using lectures, discussions and assignments.	
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**	

References:

1. Severe Pettersen (1956): weather analysis and forecasting, volume 1, McGraw-Hill
2. Thomas Ahrens, Donald C. Ahrens · 1993, Essentials of Meteorology; An invitation to the Atmosphere
3. Wiston et al.,, J Climatol Weather Forecasting 2018, 6:2 DOI: 10.4172/2332-2594.1000229
4. Severe Pettersen (1956): weather analysis and forecasting, volume 1, McGraw-Hill
5. Roger Graham Barry, Richard J. Chorley · 1970, Atmosphere, Weather and Climate, 9th Edition.
6. Wiston et al.,, J Climatol Weather Forecasting 2018, 6:2 DOI: 10.4172/2332-2594.1000229

DM 224: Hydrometeorology – 45 Hours

Module Code and Name: DM 224 HYDROMETEOROLOGY **Module level: YEAR II, SEMESTER II** **Module Credit: 3CU**	
Module description This module focuses on the link between hydrology and meteorology. It looks at interactions among hydrology, weather and climate, and how these contribute to the water cycle. Land surface is at the core of such interactions, thus dynamical and physical processes of the land-atmosphere interaction will be addressed	
Learning outcomes By the end of this module, learners should be able to describe the hydrological cycle, explain, estimate and measure ET, measure point and aerial precipitation, explain the concept of infiltration, stream flow and their measurement. The learner should also be able to examine the impacts of climate change on water resources.	
Competences The learner: • Describes the components of a hydrological cycle • Explains point and aerial precipitation measurements • Explains hydrometrics • Discusses water resource use conflicts and resolution	
Detailed Module Description	**Duration**
Sub module 1: Introduction to Hydrometeorology; • General overview (definitions, the nexus, importance, current and future demand, challenges and way forward)	**4hours**
Sub module 2: Hydrological cycle	**8hours**

• Evaporation and transpiration • Precipitation • Condensation • Transport • Infiltration and Percolation (Definitions; Influencing factors; Measurement (Inflitrometers, Sprinklers, Observations, Phi-Index, Horton's equation) • Evapotranspiration (ET) (definitions; Importance; Measurement) • Runoff • Water Balance equation	
Sub module 3: Cloud and Precipitation physics • Formation process • Forms • Types of rainfall • Rainfall measurement • Gauge distribution • Checking rainfall data consistency • Aerial precipitation measurement	**8hours**
Sub module 4: Hydrometrics • Definitions • Site for a hydrometric station • Measurement of stage (manual and automatic methods) • Measurement of discharge (Current meters, slope area method, dilution method, floating object method, hydraulic structures, radioactive tracers method)	**11 hours**
Sub module 5: Climate change and water resources • Definition of key terms • Impacts of Climate change on water resources	**4 hours**
Sub module 6: Hydro diplomacy and Water negotiations • Theories and concepts in water diplomacy (conflict and cooperation) • Water catchments and management zones in Uganda. • Introduction to tools for water diplomacy • Negotiation concepts and processes • Social aspects of shared water resources governance (local and transboundary water resource management) • Stakeholder Water conflict analysis (conflict resolution and conflict transformation) • National and international water laws, conventions and treaties	**10hours**

Mode of delivery This module will be taught by using lectures, discussions, projects and assignments.
Assessment This module will be examined through continuous and final assessment as follows Continuous assessment: 40% (Assignments 15% and Tests 25%) Final Assessment: 60% **Total 100%**

References:

1. Compendium of Meteorology – Hydrometeorology by S.I S and I Cordery,1999
2. Land surface hydrology, meteorology and climate observation and monitoring by V.J Albert and T. Schande, 2011

DM 225: Research Project – 75 Hours

Module Code and Name: DM 225 RESEARCH PROJECT **Module level: YEAR II, SEMESTER II** **Module Credit: 5CU**	
Module description This module focuses on identifying a research problem that should be investigated to its logical conclusion, climaxed by writing a report.	
Learning outcomes By the end of this module, learners should be able to produce a research report	
Competences The learner: • Identifies a societal problem • Analyses the problem • Formulates a statement of the problem • Formulates research objectives • Reviews literature • Collects data • Analyses data • Writes findings • Draws conclusions • Makes recommendations	
Detailed Module Description	**Duration**
The research report shall have the following sections • Introduction • Literature review • Methodology and methods used	**75 hours**

• Results and discussion • Conclusion and recommendations • References • Appendices	

Mode of delivery
This module will be taught by using lectures and seminars

Assessment

Final mark for the research project (DM 224) shall be calculated as follows: the research proposal writing and defense is done and assessed at the institution for 40% and the final research project reports are submitted and assessed by UBTEB for 60%.

This module will be examined through continuous and final assessment as follows

Continuous assessment: 40% (Proposal presentation 15% and defense of final project 25%).The guides for award of scores are contained in appendix 7 and 8 respectively.

Final Assessment by UBTEB: 60%

Total 100%

DM 226: Industrial Training – 75 Hours

Module Code and Name: DM 226 INDUSTRIAL TRAINING
Module level: YEAR II, SEMESTER II
Module Credit: 5CU

Module description
This module involves industry attachment and practical training in weather observation, analysis and forecasting.

Learning outcomes
By the end of this module, learners should be able to use and maintain different weather instruments, analyze as well as forecasting weather.

Competences
The learner:

- Observes weather
- Prepares weather reports
- Maintains weather instruments
- Analyses weather data
- Forecasts weather
- Plans for activities

• Research new information • Works in teams • Manages conflicts	
Detailed Module Description	**Duration**
Industrial training will cover: • Weather observations • Preparing weather reports • Communicating weather data and information • Plotting • Weather analysis, • Forecasting • Weather briefing, • Hydrometric measurements, • Provision of weather as well as climate information services and research. • Problem solving • Weather station maintenance • Weather instrument installation • Report writing • Research	**360 hours**
Mode of delivery This module will be taught by using field practice and projects	
Assessment This module will be assessed as follows: 1) Academic supervisor -20% 2) Field supervisor - 60% 3) Industrial training report – 20% **Note:** 1-3 will be guided by appendix 4-6 respectively **Total 100%**	

MODULE ASSESSMENT FORMATS FOR DIPLOMA IN METEOROLOGY AND CLIMATE SCIENCE (DMCS)

NO.	MODULE CODE AND NAME	STATUS	ASSESSMENT FORMAT
A	DM111: Mathematics DM112: Physics DM114: Statistical Methods Communication and life Skills GM 110 : Gender and climate DM121: Vector Analysis DM122: Physical Meteorology I DM123: Climate System and Analytics DM124: Synoptic Meteorology DM125: Remote Sensing GM120: Principles of Geographic Information Systems (GIS) DM126: Research Methods DM211: Tropical Meteorology DM212: Dynamic Meteorology I DM213: Physical Meteorology II DM214: Agro-meteorology DM215: Climate Change, mitigation and adaptation strategies ENV210: Environmental pollution and control DM217: Entrepreneurship Skills DM221: Dynamic Meteorology II DM222: Aviation Meteorology DM223: Principles of weather forecasting DM225: Hydrometeorology	**Theory**	• The final assessment for each of these modules shall consist of **eight** questions, each carrying **20** marks and the student shall answer **five** questions. • The questioning techniques to be applied should seek for the trainee's ability to comprehend, apply, analyze, synthesize and evaluate scenarios. • The total duration for each Assessment shall be **3** Hours

	DM113: Meteorological Instruments, Codes and Methods of Observation		• This paper shall consist of two sections, A and B. Section A shall consist of **two compulsory questions.** Section B shall consist of **five questions and a candidate shall be required to answer any three.** All questions shall carry equal marks. • The marks from this exam will be converted to 60% and added to the coursework assessment. • The total duration for each Assessment shall be **3** Hours
	DM117: Information Communication Technology (ICT)	**Practical**	• This paper shall consist of **two sections A and B.** • Section A is compulsory (Ms Word and MS Excel) • The student will be required to select one question from section B (Data base and MS Power point) • All questions shall carry equal marks. • The total duration for the Assessment shall be **3** Hours
	DPM201: Statistical Software for data analysis	**Practical**	• This paper shall consist of **FOUR** Practical questions. The student will be required to answer **three** questions.

			• All questions shall carry equal marks. • The total duration for the Assessment shall be **3** Hours
	DM224: Research Project	**Practical**	• This module shall be assessed by both the research committee of NMTS and UBTEB as follows. Continuous assessment: 40% (Proposal presentation 15% and defense of final project 25%).The guides for award of scores are contained in appendix 7 and 8 respectively. • Assessment by UBTEB shall constitute 60%.
	DM226: Industrial Training	**Practical**	• This module shall be assessed by both the field and academic supervisor as follows. i. Academic supervisor -20% ii. Field supervisor - 60% iii. Industrial training report – 20%

APPENDICES

APPENDIX 1: List of teaching staff

SNo.	Name	Qualification	Area of specialty	Status
1.	Godwin Ayesiga	PhD Atmosphere, Oceans and Climate, Msc. Applied Met, PGD Met, Bsc.Educ (Maths/Physics)	Applied meteorology	Secondment
2.	Samalie Nanyonjo	Msc. Applied meteorology, MSc, environment science, Bsc,Meteorology,Dip Met,Cert Meteorology	Core meteorology	Secondment
3.	Doreeen Nanziri	Bsc. Met (Mak), Dip Met	Core meteorology	Part time
4.	Yusuf Nsubuga	Bsc. Met (Mak), Dip Met	Core meteorology	Part time
5.	Robert Kibwika	Msc Meteorology, Bsc.Met, Dip Met	Core meteorology	Part time
6.	Christopher Sooka	Msc. Information systems, Bsc Educ(Mathematics/Physics)	Physical sciences	Full time
7.	Simon Ageet	MSc Applied Meteorology and Climate with Management, PGD. Meteorology, BSc, Dip. Meteorology	Applied meteorology	Full time
8.	Alex Asingwire	BSc Education (Maths/Physics)	Physical sciences	Full time
9.	Hassan Adiga	MSc Climate Change, PGDE, BSc. Meteorology, Dip. Meteorology	Climate science	Full time
10.	Esther Nakiwala Kigongo	MSc. Applied Meteorology, PGD.IT, B. Financial and Investment Analysis, Dip. Meteorology,	Applied meteorology	Full time
11.	Annet Lyaka	BSc Meteorology, Dip. Meteorology,	Earth systems science	Full time
12.	Paul Kato	BA. Information Technology	Computer applications	Full time
13.	Moses David Tumusiime	Msc.Climate Change, PGD Water resources,DPAM,PGD Met.	Earth systems science	Part time

APPENDIX2: Teaching Facilities-Lecture rooms

SNO.	ROOM	APPROXIMATE AREA (SQUARE METRE)
1.	DAM1	60
2.	DAM2	60
3.	DM1	84
4.	DM2	81
5.	CM1	50
6.	CM2	49
7.	Reading Room1	80
8.	Reading Room 2	80
9.	Reading Room 3	64

APPENDIX3: Other facilities

SNO.	**FACILITY**	**APPROXIMATE AREA (SQUARE METRE)**
1	Weather station	100
3	Library	25
4	Weather instrument museum	49
5	Conference room	24
6	Computer laboratory	49

Appendix4: INDUSTRIAL TRAINING ASSESSMENT FORM FOR ACADEMIC SUPERVISOR

Name of student: ……Signature: …….				
Registration No.: ……..……..				
Programme & Year of Study: ……..				
Name of Supervisor: ……..Signature: …….……				
	AREA OF ASSESSMENT	MARKS	SCORE	AREA OF IMPROVEMENT
A	Attendance (was the learner at his workplace?)	5		
B	Understanding of tasks	21		
	1. Did the learner provide weekly summary of the work performed?	2		
	2. How did the learner describe the tasks performed?	4		
	3. How was the learner able to explain why tasks were being done in a particular way?	3		
	4. How did the learner explain the problems experienced when carrying out the work and how they were solved?	3		
	5. How did the learner describe the new knowledge and skills gained?	2		
	6. How did the learner explain the knowledge and skills acquired at college that enable him to perform?	3		
	7. How did the learner explain his relationship with his co-workers and supervisors and how he/she plans to improve or maintain it?	2		
	8. How did the learner relate industrial training tasks to his/her training as a weather observer?	2		
C	General remarks (Other assessments at the discretion of the supervisor)	4		
	TOTAL	30		

Appendix5: INDUSTRIAL TRAINING ASSESSMENT FORM FOR FIELD OR ONSITE SUPERVISOR

Name of institution: ……				
Name of industry: ……				
Name of student: ……Signature: ……				
Registration No.: ……..				
Programme & Year of study: ……				
Name of supervisor: ……...Signature: ……				
	AREA OF ASSESSMENT	**MARKS**	**SCORE**	**AREA OF IMPROVEMENT**
A	Attendace (%of days and times within the days present)	5		
B	Work performance involvement	35		
	1. Ability to communicate effectively	5		
	2. Coperation with other staff	5		
	3. General ability to use various equipment, machines or plant in industry	10		
	4. Flexibility, willingness to learn from various sections in the industry	7		
	5. Job planning	8		
C	Innitiative or innovations	15		
	1. Problem solving	8		
	2. New ideas on improvement for efficiency of performance or operations	7		
D	Time management	5		
	1. Reporting time	1		
	2. Leaving at specified time	1		
	3. Meeting deadlines on assignments given by supervisors or instructors.	3		
E	Discipline and safety observations	15		
	1. Use of right equipment for right job	4		
	2. Obeying instructions given and carrying them out	4		

Appendix 6: Guide on marking of industrial training report

The report shall b e written in good english and assessed as follows

SNO.	CONTENT	MAXIMUM SCORE
1	Cover page • Name of institution • Name of learner and year • Place of industrial training • Period of training ie june2023 • Signature of field and academic supervisors	1
2	Acknowledgement	0.5
3	Abstract	0.5
4	Table of contents	0.5
5	List of tables	0.5
6	List of figures	0.5
7	List of acronyms and abbreviations	0.5
8	Introduction • Location of industry • Objectives of field attachment • Structure of organization	2
9	Main body • Activities carried out • New knowledge and skills gained • Challenges faced and how they were overcome	4
10	Conclusion	2
11	Recommendations	2
12	References(APA 7TH Edition)	0.5
13	Appendices	0.5

Appendix 7: Score guide for presentation of a research proposal

Sno.	Item	Score
1	Attendance	1
2	Smartness	1
3	Articulation of research problem	4
4	SMART research objectives	3
5	Appropriate methodology	4
6	References	2
	TOTAL	**15**

Appendix 8: Score guide for presentation of a research report

SNO.	**ITEM**	**SCORE**
1	Attendance	1
2	Smartness	2
	An overview of research problem	5
3	Presentation and discussion of results	5
4	Conclusions and recommendations	5
	Presentation skills	5
	Level of organization	2
	TOTAL	**25**

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