AFRICAN COLLEGE OF COMMERCE

P.O. BOX 301 KABALE – UGANDA

THE CURRICULUM FOR
THE DIPLOMA IN
RENEWABLE ENERGIES (DRE)

THE STRUCTURE, REGULATIONS AND SYLLABUS

YEAR 2014

VISION

To be a leading Institution in Business, Technical and Vocational Training in Africa

MISSION

To establish a competence - based training that equips the learners with skills relevant to employment and economic growth

CORE VALUES

1. **Competence based training for Skilled and competent graduates;**

2. **Integrity based on honesty and ethics;**

3. **Hard work, dedication, and achievement of results.**

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THE HISTORY OF

AFRICAN COLLEGE OF COMMERCE (ACC)

African College of Commerce is an Educational Institution majoring in Business, Technical and Vocational training programmes. Below is the historical background of the institution**.**

1986: 14th April, Commissioned as a Business Education Institution.

1986: June, Registered and recognised by the Ministry of Education.

1990: Held the first Graduation Ceremony;

1992: Introduced Computer Science Courses;

1994: Granted Examinations Centre U62 by the Uganda National Examinations Board,

1998: Purchased land on which to construct the Main Campus

2003: Affiliated to Makerere University Business School (MUBS)

2004: Shifted from rented building in Kabale town centre to Kekubo cell a kilometre away in our own buildings in an area conducive for learning

2005: Received donation from the Federal Republic of Germany in form of buildings, computers, text books and Human Resource Development.

2006: Established ICT Centers in Kabale and Kanungu Districts with the assistance of the Uganda Communications Commission.

2007: Worn a BRONZE Medal from the Federation of Uganda Employers for being the third best employer in Uganda for the year 2006.

2008: Accredited by the National Council for Higher Education as a recognized Institution of Higher learning in Uganda:

2010: Re branding African College of Commerce. Introduced more Technical and Vocational programmes and short courses.

2011: April 16th 2011, Cerebrate Silver Jubilee **1986 to 2011**. Penetrated the Rwanda, Congo, Tanzania Burundi and Kenya

2012: Transformed into a fully fledged **Polytechnic.** Engaged all the training programmes into innovation and production units for products and services. Concretised the hands on training and competence based approach.

2014: Affiliating to Kyambogo University for diploma programmes and in particular the Diploma in Instructor and Technical Teacher Education DITTE, under Skilling Uganda Strategy.

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PART A: GENERAL REGULATIONS

1.0 LIST OF ACRONYMS

DRE	Diploma in Renewable Energies
CGPA	Cumulative Grade Point Average
CH	Contact Hours
CU	Credit Units
GP	Grade Point
GPA	Grade Point Average
LH	Lecture Hours
NP	Normal Progress
PH	Practical Hours
ATPs	Assessment Training Packages
ACC	African College of Commerce
ACCAB	African College of Commerce Academic Board
ACCEB	African College of Commerce Examinations Board

2.0 TITLE

The title of the Programme is the DIPLOMA **IN RENEWABLE ENERGIES (DRE))**

3.0 INTRODUCTION

The Diploma in Renewable Energies Programme is a two year study aimed at providing students with knowledge and skills in Bio energy, Hydro energy, Wind Energy, Solar Energy and tapping other natural resources that are required in our daily use, both domestic, business and industry and in all those organizations where there is a need to use natural resources.

3.1 Rationale

Every day the Environment is degraded and the environment is polluted. The is largely due to luck knowledge, skilled people and access to alternative renewable energies. The need for use of renewable energies and tapping the natural resources is eminent as a way forward to save the environment and conserve nature. At the same time, there is an increase of in the population a factor that will increase the demand for the renewable energies.. There is therefore a great demand for skilled Engineers of Renewable Energies. The Diploma in Renewable Energies is therefore intended to address this issue.

3.2 Target Group.

The target groups are Senior Six leavers and certificate holders.

4.0 OBJECTIVE OF THE PROGRAMME

The main objective of this course is to enable students gain knowledge and skills in professional Engineering in the Renewable Energies and Tapping the Natural Resources.

5.0 PROGRAMME OUTCOME

The graduate of Renewable Energies should competently apply skills and knowledge, installation and maintenance of various plants, which generate energy

6.0. JOB TITLES THAT DRE GRADUATES ARE EXPECTED TO PERFORM

- Production Engineers
- Energy Engineers
- Maintenance Technicians
- Instructor and Trade Testing Officer
- Power/Boiler Technician
- Design Assistant

7.0 ORGANISATIONS THAT EMPLOYE DRE GRADUATES

- Wind Energy Industries
- Hydro Power stations
- Electrical Generation Companies
- Solar Industries
- Bio Energy Industries
- Self employment
- Nature Conservation offices
- Power generation, transmission and construction projects
- Technical institutions

8.0. Nature of courses.

All the courses in this programme are compulsory.

9.0 ADMISSION REQUIREMENTS

The minimum entry requirement to the Diploma in Renewable Energies

a) Uganda Certificate of Education (UCE) with at least 5 credits in Science subjects;
b) Uganda Advanced Certificate of Education (UACE) with 1 Principal pass and two subsidiaries in science subjects obtained at the same sitting or its equivalent;
c) Qualifications equivalent to Uganda Advanced Certificate of Education (UACE) as shall be determined by the National Council in consultation with the Uganda National Examinations Board;
d) A Certificate in engineering programmes obtained from a recognized institution of higher learning.

10.0 DURATION OF THE PROGRAMME

The minimum period to complete the Diploma Renewable Energies is two years and the maximum period is four years. Failure to complete the program in four years, the student will be required to repeat the whole program and forfeit the already passed course units.

11.0 MODE OF DELIVERY AND INSTRUCTIONAL STRATEGIES

The Mode of delivery and instructional strategies will be by the following:

11.1 Lectures for theory
11.2 Practical work in form of Projects
11.3 Field work through industrial training and Study tours
11.4 Class discussions and group presentations
11.5 Demonstrations

12.0 STUDY MATERIALS AND INFRASTRUCTURE

12.1 Institutional Infrastructure

The institution will use the existing facilities on ACC Campus. The institution has sufficient infrastructure to facilitate the teaching and learning process e.g. furniture, lecture rooms, workshops, library, computer laboratories and a resource room.

12.2 Study Facilities

The Faculty of Engineering will use the existing study facilities on ACC Campus. The institution has sufficient study facilities to facilitate the teaching and learning process e.g. Office materials, tools, equipment, and machinery, computers, handouts, textbooks and other materials from individual lecturers, journals and related publications, internet connectivity in the computer laboratories, library with wireless connection, audio visual materials, relevant software programme, source documents, archival records, government policy papers, Government Acts and Statutes, research and innovations by lecturers and students.

13.0 HUMAN RESOURCE

The Faculty of Engineering has a well established human resource managing the Certificate and Diploma programmes. The academic and technical staff to support the Diploma in Renewable Energies program will be drawn from the programmes under the faculty. The list of the Academic and Technical staff in the Faculty of Vocational Education is on page 78 of this curriculum.

14.0 PROGRAMME STRUCTURE

14.1 YEAR ONE SEMESTER ONE

CODE	NAME	LH	PH	CH	CU
DRE 1101	Renewable Energies	60	30	75	5
DRE 1102	Engineering Mathematics	40	40	60	4
DRE 1103	Mechanical Engineering Science	30	30	45	3
DRE 1104	Biomass Classification	30	30	45	3
DRE 1105	Building Construction	30	60	60	4
DRE 1106	Computer Applications I	20	50	45	3
DRE 1107	Engineering Drawing	30	60	60	4
DRE 1108	Renewable Energies Project I	10	130	75	5
	Total	**240**	**420**	**450**	**31**

14.2 YEAR ONE SEMESTER TWO

Code	Name	LH	PH	CH	CU
DRE 1201	Electrical Engineering Science	30	30	45	3
DRE 1202	Biogas Technologies	30	90	75	5
DRE 1203	Communication Skills	40	40	60	4
DRE 1204	Hydro Energy I	30	60	60	4
DRE 1205	Basic Electronics	30	30	45	3
DRE 1206	Computer Applications II	20	50	45	3
DRE 1207	Renewable Energies Project II	10	130	75	5
DRE 1208	Fieldwork	10	130	75	5
	Total	**200**	**560**	**480**	**32**

14.3 YEAR TWO SEMESTER ONE

CODE	NAME	LH	PH	CH	CU
DRE 2101	Biomass Thermo-Chemical Technologies	30	30	45	3
DRE 2102	Solar Thermal Technologies	30	30	45	3
DRE 2103	Thermodynamics	30	30	45	3
DRE 2104	Biomass Liquid fuel Technologies	30	30	45	3
DRE 2105	Geothermal Energy Systems	30	30	45	3
DRE 2106	Engineering Software	20	50	45	3
DRE 2107	Renewable Energies Project III	10	130	75	5
	Total	**180**	**330**	**345**	**23**

14.4 YEAR TWO SEMESTER TWO

CODE	NAME	LH	PH	CH	CU
DRE 2201	Power Transmission Systems	60	30	75	5
DRE 2202	Solar Photovoltaic Technologies	30	30	45	3
DRE 2203	Entrepreneurship Skills	50	20	60	4
DRE 2204	Hydro Energy II	30	60	60	4
DRE 2205	Wind Energy	30	30	45	3
DRE 2206	Tidal Energy	30	30	45	3
DRE 2207	Renewable Energies Project IV	10	130	75	5
	Total	**210**	**330**	**375**	**26**

15.0 PROGRAMME LOAD

To qualify for the award of a **Diploma in Renewable Energies**, a candidate must obtain a minimum of **112** credit units distributed as follows:

YEAR ONE SEMESTER ONE 31
YEAR ONE SEMESTER TWO **32**
YEAR TWO SEMESTER ONE **23**
YEAR TWO SEMESTER TWO **26**
TOTAL 112

16.0 CURRICULUM

The Curriculum for Diploma in Renewable Energies will be prepared by the African College of Commerce Academic Board (ACCAB) and accredited by the National Council for Higher Education (NCHE)

17.0 EXAMINATION REGULATIONS

The examination rules and regulations for a Diploma in Renewable Energies will be set by African College of Commerce Academic Board (ACCAB)

18.0 ADMISSIONS TO THE PROGRAMME

18.1 Admission:

Admission into the programme will close at the end of the third full week of each semester;

19.0 PROGRESSION

Progression of a student will be classified as normal, probational or retaking or discontinuation.

19.1 Normal progression

Normal progression occurs when a student passes each course taken with a minimum grade point of 2.00

19.2 Probationary progress

This is a warning stage and it occurs when a student;

(i) Fails a course unit
(ii) Has GPA or CGPA of less than 2.00

19.3 Stay put

A student who fails more than a half of the total number of courses in a semester will be required to stay on that semester until the failed courses are cleared. When the GPA of a student goes up in the following semester, the probation is removed.

19.4 Retaking

A student will retake any course when it is next offered, to pass or to improve performance. A student will retake in a course only two times.

19.5 Discontinuation

A student is discontinued when he or she has:

(i) Received three (3) consecutive probations in the same course unit.
(ii) Received a CGPA of less than 2.00 for three consecutive probations.
(iii) Failed to present him/her-self for final examinations without giving sufficient reasons.
(iv) Over stayed on the programme for a period of more than four years

20.0 FINAL EXAMINATION PAPER FORMAT

20.1 YEAR ONE SEMESTER ONE

PAPER NAME AND CODE	EXAMINATION FORMAT
DRE 1101 Renewable Energies DRE 1102 Engineering Mathematics DRE 1103 Mechanical Engineering Science DRE 1104 Biomass Classification DRE 1105 Building Construction DEE 1107 Engineering drawing	Each paper will consist of **seven** questions and the candidate will be required to answer **at least five**. All questions carry equal marks. The students will be assessed on memory, understanding, application, analysis, synthesis and evaluation. The duration of the examination will be three hours
DRE 1106 Computer Applications I	The paper will consist of three exercises and the candidate will be required to answer all. The total duration of the examination will be two hours.
DRE 1108 Renewable Energies Project I	Continuous assessment of the various projects in the semester will lead to the final examinations paper marks. The duration of the assessment will be within 15 weeks of teaching African College of Commerce will invite an expert /examiner to assess the projects

20.2 YEAR ONE SEMESTER TWO

PAPER NAME AND CODE	EXAMINATION FORMAT
DRE 1201 Electrical Engineering science DRE 1202 Biogas Technologies DRE 1203 Communication Skills DRE 1204 Hydro Energy I DRE1205 Basic Electronics	Each paper will consist of **seven** questions and the candidate will be required to answer **at least five**. All questions carry equal mark students will be assessed on memory, understanding, application, analysis, synthesis and evaluation. The duration of the examination will be three hours
DRE1206 Computer Applications II	The paper will consist of three exercises and the candidate will be required to answer all. The total duration of the examination will be two hours.
DRE 1207 Renewable Energies Project II	Continuous assessment of the various projects in the semester will lead to the final examinations paper marks. The duration of the assessment will be within 15 weeks of teaching. African College of Commerce will invite an expert /examiner to assess the projects

20.3 YEAR TWO SEMESTER ONE

PAPER NAME AND CODE	EXAMINATION FORMAT
DRE 2101 Biomass Thermo-Chemical Technology DRE 2102 Solar Thermal Technologies DRE 2103 Thermodynamics DRE 2104 Biomass Liquid fuel Technologies DRE 2105 Geothermal Energy Systems	Each paper will consist of **seven** questions and the candidate will be required to answer **at least five**. All questions carry equal marks. The students will be assessed on memory, understanding, application, analysis,

	synthesis and evaluation. The duration of the examination will be three hours
DRE 2106 Engineering Software	This paper will consist of one practical section. It will consist of two practical questions and a candidate will be required to answer at least one questions. Section B will consist of three practical questions and a candidate will be required to answer at least two questions. The duration of the this practical examination shall be five hours
DRE 2107 Renewable Energies Project III	Continuous assessment of the various projects in the semester will lead to the final examinations paper marks. The duration of the assessment will be within 15 weeks of teaching. African College of Commerce will invite an expert /examiner to assess the projects

20.4 YEAR TWO SEMESTER TWO

PAPER NAME AND CODE	EXAMINATION FORMAT
DRE 2201 Power Transmission system DRE 2202 Solar Photovoltaic Technologies DRE 2203 Entrepreneurship Skills DRE 2204 Hydro Power II DRE 2205 Wind Energy DRE 2206 Tidal Energy	Each paper will consist of **seven** questions and the candidate will be required to answer **at least five**. All questions carry equal marks. Students will be assessed on memory, understanding, application, analysis, synthesis and evaluation. The duration of the examination will be three hours
DRE 2207 Project IV	Continuous assessment of the various projects in the semester will lead to the final examinations paper marks. The duration of the assessment will be within 15 weeks of teaching. African College of Commerce will invite an expert /examiner to assess the projects

21.0 ASSESSMENTS AND GRADING

21.1 Theory Assessment

21.1.1	Continuous Course Work	
	21.1.1.1 Course work 1	10%
	21.1.1.2 Course work 2	10%
	21.1.1.3 Course work 3	10%
	Total	**30%**
21.1.2	End of Semester Examination	**70%**
	Total	**100%**

21.2 Project Work

21.2.1	Project Assessment 1	20%
21.2.2	Project Assessment 2	20%
21.2.3	Student's Personal Innovation	20%
21.2.4	Project Assessment 4	40%
	Total	**100%**

21.3 Field Work

21.3.1	Industrial Training	70%
21.3.1	Field Tours	30%
	Total	**100%**

21.4 Assessment Training Packages (ATPs)

Each student will be assigned an Assessment Training Package. This will record the student's academic progression. This will include assessment areas, grades obtained from course works, project work, field work and final examination.

21.5 Grading courses

Each course unit will be graded out of a maximum of one hundred (100) marks and assigned grade point as follows

MARKS (%)	GRADE POINTS
80-100	5.00
75-79	4.50
70-74	4.00
65-69	3.50
60-64	3.00
55-59	2.50
50-54	2.00
Below 50	0.00

The course pass mark is 50% which is Grade Point 2.0.
No credit unit will be awarded for any course in which a student fails.

21.6 Scaling

All the grades will be scaled down to 100%

22.0 AWARDS AND CLASSIFICATION

22.1 Awards

A successful candidate will be awarded the Diploma in Renewable Energies of African College of Commerce (ACC)

22.2 Grade Point Average (GPA)

A grade point average is mark calculated to determine the final award. To arrive at a grade point average, the following steps are taken.

a. Multiply the Grade Point by the Credit Unit to get a Weighted Score of a Course;
b. Add together the weighted scores for all courses taken up to that time to get **total weighted score(TW);**
c. Add the Credit Units for each course to get the **Total Credit Units (TCUs);**
d. Divide the total weighed scores by the total number of credit units taken up to that time to get **grade point average (GPA). TWs/TCUs =GPA.**

The letter grades shall be used for Grade Point Averages (GPAs) as follows:

A	B+	B	C	D
5	4	3	2	1

22.3 Cumulative Grade Point Average (CGPA)

This is determined by dividing total accumulated weighted scores (TWs) by the total accumulated credit units (TCUs) up to a particular time.

22.4 Classification of Final Awards

CLASS	**FINAL CGPA**	**LETTER GRADE**
First Class	4.4 – 5.0	A
Second Class Upper Division	4.0 – 4.3	B+
Second Class Lower Division	3.0 – 3.9	B
Pass	2.0 – 2.9	C
Fail	1 - 1.9	D

PART B: GENERAL DESCRIPTION

23.0 YEAR ONE SEMESTER ONE

23.1 BASICS OF RENEWABLE ENERGIES

COURSE CODE **DRE 1101**

CREDIT UNITS **04**

CONTACT HOURS **60**

Course description
This course introduces students to the renewable energies, different sources of energies, and the importance of renewable energy in social, and economic development.

LEARNING OUTCOME
Students should be able to explain the different types of renewable energies and applications, classify of renewable energies, introduction to renewable energy technologies such as biogas, gasification, biofuels, solar thermal, solar PV, hydropower, others

OBJECTIVES
By the end of this course students should be able to

- Know some important Definitions such as, 'energy', 'renewable energy', 'sustainable energy', 'conventional energy', etc;
- Explain the different sources of Energy
- Explain the different types and or classifications of energy forms/carriers
- Understand the importance of renewable energy in social, political and economic development;
- Understand the relationship between energy and the millennium development goal
- Understand the interrelation between energy use and consumption;
- Classify of renewable energies;
- Introduction to renewable energy technologies such as biogas, gasification, biofuels, solar thermal, solar PV, hydropower, others.

COURSE CONTENT

CHAPTER ONE
1.0 Important Definitions
1.1 Energy
1.2 Renewable energy
1.3 Sustainable energy
1.4 Conventional Energy

CHAPTER TWO
2.0 Sources of Energy.
2.1 The sun as the main source (Solar)
2.2 Fossil fuels

2.3 Bioenergy
2.4 Geothermal
2.5 Wind Energy
2.6 Hydro

CHAPTER THREE
3.0 Types/Classifications of Energy Forms/Carriers
3.1 Mechanical Energy
3.2 Chemical Energy
3.3 Elect rical Energy
3.4 Nuclear Energy
3.5 Thermal Energy
3.6 Radiant Energy

CHAPTER FOUR
4.0 Importance of renewable energy in social, political and economic development
4.1 The Importance of Energy Services to society
4.2 Energy for Cooking
4.2 Electricity for Urban and Peri-Urban Areas
4.3 Modern Energy Services for Rural Communities
4.4 Energy Technology Options and the Environment

CHAPTER FIVE
5.0 Energy and the millennium development goal
5.1 Growth and Income Poverty Reduction (MDG Target 1)
5.2 Hunger (MDG Target 2)
5.3 Education (MDG Target 3)
5.4 Gender Equality (MDG Target 4)
5.5 Health (MDG Targets 5–8)
5.6 Environmental Sustainability (MDG Target 9)
5.7 Water Supply and Sanitation (MDG Target 10)

CHAPTER SIX
6.0 Classification of renewable energies
6.1 Bio-energy
6.2 Solar Energy
6.3 Hydro Energy
6.4 Wind Energy
6.5 Others

CHAPTER SEVEN
7.0 Introduction to renewable energy technologies
7.1 Bio-energy Technologies such as: biogas digesters, gasification, pyrolysis, Bio-fuels, etc.
7.2 Solar PV
7.3 Solar Thermal
7.4 Wind Turbines
7.5 Geothermal Technologies
7.6 Hydropower Technologies

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. "Worldwide Electricity Production From Renewable Energy Sources: Stats and Figures Series: Fifteenth Inventory – Edition 2013". 2.2 Electricity Production From Wind Sources: Main Wind Power Producing
2. WindpoweringAmerica.gov, 46. U.S. Department of Energy; Energy Efficiency and Renewable Energy
3. Dolf Gielen. "Renewable Energy Technologies: Cost Analysis Series: Wind Power" *International Renewable Energy Agency*, June 2012. Accessed: 19 October 2013. Quote: "wind is capital intensive, but
4. Eilperin, Juliet; Steven Mufson (16 April 2009). "Renewable Energy's Environmental Paradox". *The Washington Post*. Retrieved 17 April 2009.
5. Fthenakis, V.; Kim, H. C. (2009). "Land use and electricity generation: A life-cycle analysis". *Renewable and Sustainable Energy Reviews* 13 (6–7): 1465. doi:10.1016/j.rser.2008.09.017. edit
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8. Energy.com. Archived from the original on 2011-08-25.
9. "Impact of Wind Power Generation in Ireland on the Operation of Conventional Plant and the Economic Implications". eirgrid.com. February 2004. Archived from the original on 2011-08-25. Retrieved 22 November 2010.

23.2 ENGINEERING MATHEMATICS I

COURSE CODE **DRE 1102**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION:
This course introduces students to the foundation of Mathematics. It deals with laws and relevant equations which help in solving daily problems.

LEARNING OUTCOME
Students will be able to apply the mathematical concepts to solve various problems involving evaluation and analysis of materials and their related costs.

OBJECTIVES OF THE COURSE
By the end of this course the learner should be able to:
1. Calculate and change bases
2. Apply the laws of indices and logarithms
3. Solve mathematical problems involving roots and polynomials
4. Solve simultaneous and quadratic equations
5. Identify and calculate different types of matrices

COURSE CONTENT

CHAPTER ONE
1.0 **Indices and Logarithms**
1.1 Definitions
1.2 Laws of Indices
1.3 Fractional and Negative Indices
1.4 Multiplication and Division
1.5 Rationalization
1.6 Equations Involving Indices
1.7 Theory of Logarithm
1.8 Common Logarithm
1.9 Equation Involving In Logarithmic Functions
1.10 Logarithmic Graphs

CHAPTER TWO
2.0 Elements of mathematics
2.1 Set theory of relations and fractions
2.2 Number theory
2.3 Boolean algebra
2.4 Switching circuits and laws
2.5 Logic and compound statements
2.6 Truth tables
2.7 Combinations and permutations

CHAPTER THREE
3.0 Identification of roots
3.1 Polynomial equations

3.2 Depression of polynomial to lower degrees by long division
3.3 Polynomials with imaginary roots
3.4 Curve sketching for second & third order polynomials
3.5 Applied problems involving polynomials
3.6 Remainder theorem and its application in the solutions of polynomial equations
3.7 Linear Functions & approximations
3.8 Graphs of Functions

CHAPTER FOUR
4.0 SERIES
4.1 Sequences and Series
4.2 Sequences, Series
4.3 Arithmetic and Geometric Series
4.4 Methods of Summation of Finite Series
4.5 Convergence Principle of Series
4.6 Tests for Convergence and Divergence of Series
4.7 The Logarithm Series
4.8 Exponential Functions
4.9 Binomial series
4.10 Power Series
4.11 Uniform Convergences

CHAPTER FIVE
5.0 Equations
5.1 Definitions
5.2 Simultaneous
5.3 Quadratic Equations
5.4 The General Quadratic Equation by use of Completing the Square & factor method.
5.5 Partial Fractions

CHAPTER SIX
6.0 Matrices
6.1 Definitions
6.2 Matrix Algebra
6.3 Types of Matrices (Addition, Subtraction & Multiplication)
6.4 Determinants
6.5 Crammers rule for solving equations
6.6 Inverse matrices by row reduction method & adjoint method (Echelon Matrices)
6.7 Solution of matrix equations using inverse matrices and Eigen values

CHAPTER SEVEN
7.0 Trigonometry
7.1 Identities and Trigonometric equations
7.2 Hyperbolic functions and their identities
7.3 Sine Rule, cosine rule and area of triangle
7.4 Compound angles, Double angles, half angles and their applications
7.5 Solution of trigonometric equations and its applications
7.6 Graphical addition to sine wave with a phase displacement
7.7 Relationship between trigonometric & hyperbolic functions
7.8 Factor formulae

CHAPTER EIGHT

8.0 Differentiation

8.1 Differentiation of standard functions from first principles
8.2 Fractional indices
8.3 Alternative notations for first & second derivatives
8.4 Derivatives of sine x & cosx
8.5 Derivatives of other trigonometric functions
8.6 Differentiation of Algebraic, Exponential. Logarithmic & Hyperbolic functions
8.7 Applications of differentiation to rates of changes including curvatures Maxima & Minima
8.8 Approximate roots to equations
8.9 Development of products & quotients of functions
8.10 Chain rule
8.11 Partial Differentiation

CHAPTER NINE

9.0 Integration

9.1 Definition
9.2 Geometrical interpretation
9.3 Area under a curve
9.4 Definite & infinite integrals
9.5 Multiples Integrals
9.6 Integration by parts
9.7 Integration by resolving into partial fractions
9.8 First order differential equations
9.9 Integration of trigonometric functions
9.10 Integration by change of variables
9.11 Applications of Integration finding areas, volumes of revolution, length of arcs,
9.12 centroids, and surface areas of solids of revolution moments of inertia
9.13 Pappu's theorems
9.14 Radius of gyration
9.15 Parallel axes theorem
9.16 Perpendicular axes theorem (Thin plates)
9.17 Second moment of area
9.18 Centers of pressure
9.19 Curves and curve sketching
9.20 Probability and Moment Generating Function
9.21 Random Variables
9.22 Variance

CHAPTER TEN

10.0 Statistics

10.1 Definition
10.2 Variables
10.3 Frequency distribution
10.4 Class boundaries
10.5 Histogram
10.6 Standard deviation
10.7 Central tendency
10.8 Coding & decoding
10.9 Dispersion
10.10 Frequency curves
10.11 Normal distribution curves

CHAPTER ELEVEN

11.0 Probability

11.1 Definition of probability
11.2 Events (independent & dependent events)
11.3 Conditional probability & mutually exclusive events
11.4 Discrete and Continuous Distributions
11.5 Parameters
11.6 Probability Theory
11.7 Conditional Probability
11.8 Partitions
11.9 Total Probability
11.10 Mathematical Expectation

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Engineering Mathematics 2nd Edition by K. A. Stroud
2. Advanced Modern Engineering Mathematics, Fourth Edition by Glyn James 203
3. An introduction to Mathematics for Engineers (Mechanics) by Stephen Lee

23.3 MECHANICAL ENGINEERING SCIENCE

COURSE CODE **DRE 1103**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the mechanical elements used in design considerations to establish the sizes of members,

LEARNING OUTCOMES
Students will be able to calculate forces between work, power and energy and differentiate between coplanar and non coplanar forces,

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to:
1 Calculate forces in members of the frames
2 Resolve frameworks
3 Differentiate between coplanar and non coplanar forces
4 Appreciate the laws of friction
5 Define work, power and the differentiate forms of energy

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Elementary Statics
1.1 The concept of force and mass.
1.2 Composition and resolution of coplanar forces, (definition of resultant and equilibrant forces).
1.3 Parallelogram and triangle of forces.
1.4 Polygon of forces and Bow's notation.
1.5 Application.
1.6 Analytical and graphical method of summation of forces.
1.7 Algebraic composition and resolution of: Non-concurrent coplanar and concurrent non-coplanar force systems.
1.8 Equilibrium of rigid bodies subjected to non-coplanar forces' system, vectorially by force and link polygons

CHAPTER TWO
2.0 Frameworks (Statics)
2.1 Determine statically determinate frameworks.
2.2 Resolve frameworks analytically
2.3 Resolve frameworks graphically

CHAPTER THREE
3.0 Moment of forces and Couple
3.1 Theorem of moments centres of area and gravity.

CHAPTER FOUR
4.0 Kinematics
4.1 Linear and angular motions; velocity and acceleration.
4.2 Circular motion – angular displacement, angular velocity and angular acceleration.

4.3 Periodic motion, simple harmonic motion.
4.4 Relation between linear and angular variables (velocity and acceleration).
4.5 Centripetal force (derivation) and centrifugal force.
4.6 Banking of roads.

CHAPTER FIVE
5.0 Friction
5.1 Static and kinetic friction and other types of forces.
5.2 Angles of friction; application of a body on a rough inclined plane.
5.3 Power lost in friction.
5.4 Laws of friction.
5.5 Friction in a square threads screw.
5.6 Applications of friction in brakes of vehicles, ladders, wedges, ball bearings.
5.7 Viscosity.

CHAPTER SIX
6.0 Inertia
6.1 Static and Dynamic balancing of forces.
6.2 Out-of-balance force for rotating masses.
6.3 The maximum and minimum load on bearings

CHAPTER SEVEN
7.0 Work, Energy and Power
7.1 Work: definition and its SI units. Work done in moving an object on horizontal and inclined plane incorporating frictional forces).
7.2 Power: definition and its SI units, calculation of power in simple cases.
7.3 Energy: definition and its SI units; types: kinetic energy and potential energy with examples and their derivation.
7.4 Principle of conservation of mechanical energy (for freely falling bodies), transformation energy from one form to another, relation between work, heat and energy.

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Mechanical engineering Science (Hannah and Hillier, 3rd Edition)
2. Engineering Mechanics (2012) – Russell C Hibbler
3. Mechanical Engineers' handbook 2006 (Myer Kutz)
4. Engineering Physicis and mechanics (2010)= Matias sosa and Julian Franco
5. Higher Engineering Science (2004) – W Bolten
6. Applied Mechanics (Hannah and Hillier 3rd Edition
7. Mechanical engineering principles (2012) J.O Bird

23.4 BIOMASS CLASSIFICATION AND CHARACTERIZATION

COURSE CODE **DRE 1104**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the necessary knowledge and skills required during biomass classification and characterization and know the of elemental composition of Biomass

LEARNING OUTCOMES
Students will be able to classify and characterize biomass, identify Ultimate and Proximate analysis,

OBJECTIVES
By the end of this course, learners should be able to:
1. Explain types and sources of biomass
2. Identify properties of biomass
3. Determine elemental composition of Biomass
4. Determine Heating value of Biomass
5. Describe Ultimate and Proximate analysis
6. Explain biomass characteristics related to the environment.

COURSE CONTENT

CHAPTER ONE
1.0 Types and sources of biomass
1.1 Definition of Biomass
1.2 How Biomass is formed
1.3 Biomass as an energy carrier
1.4 Woodfuel; Biomass processing residue; Animal waste; Urban wood waste; Municipal solid waste; Landfill gas and Energy crops

CHAPTER TWO
2.0 Properties of biomass
2.1 Moisture content
2.2 Ash content
2.3 Volatile matter content
2.4 Heating value
2.5 Bulk Density

CHAPTER THREE
3.0 Elemental Composition of Biomass
3.1 Carbon
3.2 Hydrogen
3.3 Oxygen
3.4 Nitrogen
3.5 Sulphur
3.6 Ash

CHAPTER FOUR

4.0 Heating value of Biomass

4.1 Definition of Heat/calorific value

4.2 Definition and determination of Higher/Upper Calorific Value (HHV)

4.3 Definition and determination of Lower/Net Calorific value

4.4 Bomb Calorimeter

CHAPTER FIVE

5.0 Determination of Ultimate and Proximate analysis

5.1 Determination of Moisture content; Organic matter; and ash content

5.2 Evaluation of carbon, hydrogen, oxygen nitrogen, sulphur, Ash and HHV of a fuel

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Cedric Briens, Jan Piskorz and Franco Berruti, "Biomass Valorization for Fuel and Chemicals Production -- A Review," 2008. International Journal of Chemical Reactor Engineering, 6, R2
2. Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker (August 2008). *Biofuels Engineering Process Technology*. [McGraw-Hill]. ISBN 978-0-07-148749-8.
3. IChemE Energy Conversion Technology Subject Group (May 2009). *A Biofuels Compendium*. [IChemE]. ISBN 978-0-85295-533-8.
4. Fuel Quality Directive Impact Assessment
5. Biofuels Journal
6. James Smith (November 2010). *Biofuels and the Globalisation of Risk*. [Zed Books]. ISBN 978-1-84813-572-7.
7. Mitchell, Donald (2010). *Biofuels in Africa: Opportunities, Prospects, and Challenges* (Available in PDF). The World Bank, Washington, D.C. ISBN 978-0-8213-8516-6. Retrieved 2011-02-08.
8. Li, H.; Cann, A. F.; Liao, J. C. (2010). "Biofuels: Biomolecular Engineering Fundamentals and Advances". *Annual Re*

23.5 BUILDING CONSTRUCTION I

COURSE CODE DRE 1105

CREDIT UNITS 04

CONTACT HOURS 60HOURS

COURSE DESCRIPTION:
This Course introduces students to the basics knowledge of building and materials for construction, construction activities and Primary and Secondary Elements

LEARNING OUTCOMES
Students will able to define the building terms, conduct site investigation, preparation and set out a building and interpret building drawings & plans

OBJECTIVES OF THE COURSE
By the end of this course the learner should be able to;
1. Define the building terms
2. Interpret building drawings & plans
3. List the building regulation as applied in construction industry
4. Identify a datum peg & a building line
5. Conduct site investigation, preparation and set out a building

COURSE CONTENT
CHAPTER ONE
1.0 **Introduction**
1.1 Introduction
1.2 Built Environment
1.3 Primary and Secondary Elements
1.4 Construction Activities
1.5 Construction Documents
1.6 Construction Drawings
1.8 Construction Regulation
1.10 Safety Signs and Symbols
1.11 Building Regulations
1.13 Construction standards (European and British Standards
1.16 Levels and Angles
1.17 Road Construction
1.18 Shoring

CHAPTER TWO
2.0 **Builders/site Plant**
2.1 General Consideration
2.2 Bull Dozer
2.3 Scrapers
2.4 Graders
2.5 Tractors Shovel
2.6 Excavators
2.7 Transport Vehicles
2.8 Hoists
2.9 Rubble and Skips

2.10 Cranes
2.11 Concreting

CHAPTER THREE

3.0 **Site and Temporary Works**
3.1 site Investigation
3.2 Site Selection
3.3 Site suitability
3.4 Site works and setting out (preparation and organization)
3.4.1 Site access
3.4.2 Hoarding
3.5 Temporally services (Electric, water and sanitation)
3.6 Materials Storage (timber, bricks/blocks, cement, aggregates, re-enforcing bars, drainage pipes, man hall rings, scaffolding equipments, flammable liquids and compressed gasses
3.7 Construction plant – requirements for concrete mixing, bending of steel reinforcing, steel member fabrication, brick/block making and casting of concrete drainage pipes and manhole rings
3.8 Accommodation – office, workers
3.9 Subsoil drainage
3.10 Clearing and excavation
3.10.1 Demolition
3.10.2 Vegetation clearing
3.10.3 Earth moving/excavation
3.10.3 Rock removal – blasting including explosives, detonators, dynamites, procedures and safety, compressed air hammers, rippers
3.11 Setting out building using 3, 4, 5, square and dumpy level methods
3.12 Excavation and Timbering
3.13 Backfilling and compaction – methods properties of different fill types, compaction requirements and equipment, backfilling of foundation and retaining walls.
3.14 Surface water and ground water control – surface water drainage (site grading, drainage ditches), ground water dewatering (considerations, types – swamps and wall points)

CHAPTER FOUR

4.0Substructure

4.1 Trenches and Basement Excavation
4.2 Foundations
4.3 Reinforced Concrete Foundation
4.4 Concrete
4.5 Retaining Walls
4.6 Basements
4.7 Trees Effects on Foundations
4.8 Stone Work

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Building construction hand book 4th edition by Roy Chudley and Greeno,
2. Construction Technology 6th edition by Roy Chudley,
3. Building construction by R. Barry,
4. Construction Technology 4thedition by Roy Chudley,

23.6 COMPUTER APPLICATIONS I

COURSE CODE **DRE 1106**

CREDIT UNIT **03**

CONTACT HOURS **45**

COURSE DESCRIPTION

The course introduces students to the computer applications of introduction to computers, micro soft word and Excel.

LEARNING OUTCOMES

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

1. Efficiently connect computers and their accessories
2. Produce documents using Microsoft word
3. Manipulate figures using spreadsheets,

OBJECTIVES

By the end of this course learners should be able to:

1. Identify the different Applications within an Office environment
2. Acquire skills in basic computer software applications and apply them in various business situations in order to facilitate the information management function.
3. Appreciate computer applications in business through hands on
4. Demonstrate the ability to use the common software applications of Microsoft Word, and Microsoft Excel
5. Produce business documents and data analysis and models applicable to business environment

COURSE CONTENT

CHAPTER ONE

1.1 Basic concepts and startup procedures
1.2 Introduction to practical computing
1.3 Connecting computer parts (CPU, Monitor, Mouse, Key board)
1.3 Windows Operating Systems Commands
1.4 Booting the computer
1.5 Using the mouse
1.6 Managing the user interface
1.7 Introduction to Windows programmes

CHAPER TWO

2.0 Word Processing (Document production with MS word)
2.1 Starting Ms Word
2.2 Creating documents
2.3 Looking at and using tool bars
2.4 Entering data
2.5 texts formatting

2.6 page formatting
2.7 Document formatting
2.8 Creating tables
2.9 Sorting and filtering data (plain text and tabulated text)
2.10 Graphics
2.11 printing
2.12 practice assignments

CHAPTER THREE

3.0 Spreadsheets (Microsoft Excel)

3.1 Starting Ms Excel
3.2 Excel tool bars
3.4 Managing workbooks and worksheets
3.5 Entering data and its formatting
3.6 Performing formulae, errors and their corrections
3.7 Calculating using functions
3.8 Sorting and filtering data
3.9 Using Graphs
3.10 Printing
3.11 Practice assignments

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Kathy Ivens and Thomas Barich(1997), How to use Microsoft Office' 97, Ziff-Davis press
2. Whitecomb A and Brown B, Key boarding and Document production, Stanley Thornes, **Chem.: emam**
3. E.S. Waburoko(200), An introduction to information technology, Department to Distance Learning, Edsoft Computer Institute
4. Teach yourself Microsoft Excel 97 in 24 Hours by Linda Jones and Reul L. Hernadez by S: MS
5. Hernandez cy SAW Publishing
6. Keneth C. and Laudon J.P: Essentials of Management Information Systems; 3rd Edition Prentice Hall, New Jersey, 1999
7. Elliot G. and Starkings:Business Information Technology, Theory and Practice; Addison Wesley, Longman, London and New York, 1998
8. Olive and Chapman; Data Processing and Information Technology, DP Publications
9. Christopher Barnatt (1996): Management Strategy; ND Information Technology; International Thomson Business Press.

23.7 ENGINEERING DRAWING

COURSE CODE **DRE 1107**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION
This course introduces students to the skill of reading, interpreting, and producing working drawings, construct internal and external tangents, arcs to circles of both equal and unequal diameters in the design of a gasket of various parts of machines and doors.

LEARNING OUTCOME
Students will be able to read, interpret, and produce working drawing, construct perpendicular and parallel lines, bisects and divides a line into equal parts in making a scale, construction of square threads, used in planning for production of components.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to;
1. Identify and uses correctly drawing equipment to produce working drawings.
2. Construct perpendicular and parallel lines, bisects and divides a line into equal parts in making a scale, construction of square threads, used in planning for production of components.
3. Construct internal and external tangents, arcs to circles of both equal and unequal diameters in the design of a gasket of various parts of machines and doors.

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Technical Drawing
1.2 Setting of a Paper and paper sizes
1.3 Lettering
1.4 Lines
1.5 Dimensions and dimension styles
1.6 Reading and drawing to scale

CHAPTER TWO
2.0 Drawing Instruments and Drawing Boards
2.1 Simple Geometrical Construction
2.2 Plane Figures
2.3 Polygons
2.4 Principles of Tangent
2.5 Circle

CHAPTER THREE
3.0 Special Curves and loci
3.1 Ellipse
3.2 Parabola
3.4 Hyperbola

CHAPTER FOUR

4.0 Principles of Orthographic Projection
4.1 Drawing paper planning
4.2 1st and 3rd angle projection
4.3 Three view drawing of regular objects
4.4 Dimensioning of orthographic drawing

CHAPTER FIVE

5.0 Isometric and Oblique drawings
5.1 Principles
5.2 Objects with isometric and isometric line
5.3 Projections / Use & application

CHAPTER SIX

6.0 Production of Drawing/ Reading and Interpretation of Drawings.
6.1 Complete Building Drawings
6.2 Design Simple Structure

CHAPTER SEVEN

7.0 Engineering drawing, road sections, manholes, septic tanks, open channels

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Technical Drawing Advanced Level 1st Edition by Erick Isanga
2. Carpentry & Joinery by Peter Blett Level II
3. Architectural graphics by Francis D.K Ching
4. Basic engineering drawing by R.S.Rhodes and L.B Cook

23.8 RENEWABLE ENERGIES PROJECT I

COURSE CODE **DRE 1108**

CREDIT UNITS **04**

CONTACT HOURS **60**

PROJECT DESCRIPTION
This project introduces students to the practical skills in fabrication, machining and fitting of various engineering components. Fabrication involves design, drawings, forming/machining, joining, fitting, and finishing and assembly.

PROJECT OUTCOME
By the end of this project students will be able to fabricate machine components and finished products made up of steel materials.

PROJECTS ACTIVITIES
1 G-clamp, vice, screw jack
2 Pushable wheel cart
3 Making wheel barrows,
4 Making steel panel and flush doors with louvers
5 Hearth for heat treatment
6 Making manual furnace wheel air blower
7 Saloon rotating seats,
8. Innovation**:** Student's self initiated project relevant to the programme.

MODE OF DELIVERY
The mode of delivery will be through demonstrations, illustrations, site visits, guided discussion, practical work, report writing and presentations

ASSESSMENT OF THE COURSE
This course unit will be assessed on 100 marks as follows:

Project Assessment 1	20%
Project Assessment 2	20%
Student's Personal Project	20%
Project Assessment 4	40%
Total	**100%**

The marks will be converted into Grade points.

24.0 YEAR ONE SEMESTER TWO

24.1 ELECTRICAL ENGINEERING SCIENCE

COURSE CODE 1201

CREDIT UNITS 03

CONTACT HOURS 45

COURSE DESCRIPTION
This course introduces students to the basic concepts and definition of relevant terminologies of electrical circuit, the DC circuit analysis, principles of magnetism, the AC circuit analysis and Practical work, and in estimation of power losses in dc and ac circuit systems and the design of electro-mechanical machines.

LEARNING OUTCOMES
Students will be able to use basic electrical technologies, applies the various theorems to analyze and estimates power losses in dc and ac circuit scenarios.

OBJECTIVES OF THE COURSE
By the end of the course, students should be able to;
1. Apply basic concepts relevant to electrical terminologies
2. Use electric measuring instruments such as voltmeter, ammeter, etc
3. Calculate electrical power
4. Identify basic electric circuit components and uses
5. Construct electric circuits

COURSE CONTENT

CHAPTER ONE
1.0 Basic Concepts and Definition of Relevant Terminologies
1.1 Electric charge, electric current, potential difference and electrical power.
1.2 Introduction to electric circuit components including resistors, inductors and capacitors.

CHAPTER TWO
2.0 The DC Circuit Analysis
2.1 Ohms law and its relevance.
2.2 Resistor arrangement in circuit (series, parallel and combination).
2.3 Circuit theorems including potential divider, current divider, Kirchhoff's laws, the Superposition theorem, maximum power transfer theorem, Thevenin's theorem and Norton's theorem.
2.4 The 2-wire distribution system.
2.5 Comparison of the radial and ring distribution networks.

CHAPTER THREE
3.0 Principles of Magnetism
3.1 Concepts and definitions of basic magnetic terms including magnetic flux, flux density and magnetic field intensity, properties of magnetic field lines, magnetic induction including Faraday's law and Lenz's law, the magnetic circuit analysis including magneto-motive force, magnetic reluctance and

permeability, comparison of a magnetic circuit with an electric circuit, the B-H characteristics of various materials, the hysteresis loop.

CHAPTER FOUR

4.0 The AC Circuit Analysis

4.1 Single phase circuit components, resistors, impendence and their variance with frequency; capacitive reactance (RC), inductive reactance (RL) and impedance as a result of capacitive and inductive reactance (RLC) circuit analysis.

4.2 Resonance: introduction to use of phasor diagrams to illustrate lagging, leading and in-phase circuits, power in AC circuits (active power, apparent and reactive power).

4.3 Power factor and its impact on circuit design: multiphase (especially 3-phase) circuits analysis; the star and delta connection, relationship between phase and line variables (currents and voltages) power in 3-phase network and its measurement in both balanced and unbalance system.

CHAPTER FIVE

5.0 Practical work

5.1 Learners practice on identification and connection of; resistors, magnetic circuits, DC and AC circuits.

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Abramson, Albert (1955). *Electronic Motion Pictures: A History of the Television Camera*. University of California Press.
2. Bayoumi, Magdy A.; Swartzlander, Earl E. (31 October 1994). *VLSI Signal Processing Technology*. Springer. ISBN 978-0-7923-9490-7.
3. Bhushan, Bharat (1997). *Micro/Nanotribology and Its Applications*. Springer. ISBN 978-0-7923-4386-8.
4. Bissell, Chris (25 July 1996). *Control Engineering, 2nd Edition*. CRC Press. ISBN 978-0-412-57710-9.
5. Chandrasekhar, Thomas (1 December 2006). *Analog Communication (Jntu)*. Tata McGraw-Hill Education. ISBN 978-0-07-064770-1.
6. Chaturvedi, Pradeep (1997). *Sustainable Energy Supply in Asia: Proceedings of the International Conference, Asia Energy Vision 2020, Organised by the Indian Member Committee, World Energy Council Under the Institution of Engineers (India), During November 15-17, 1996 at New Delhi*. Concept Publishing Company. ISBN 978-81-7022-631-4.

24.2 BIOGAS TECHNOLOGIES

COURSE CODE **DRE 1202**

CREDIT UNITS **05**

CONTACT HOURS **75**

COURSE DESCRIPTION
This course introduces students to students the necessary knowledge and basic skills about biogas systems and related technologies.

LEARNING OUTCOMES
Students will be able to understand the principle behind biogas technologies and systems.

OBJECTIVES OF THE COURSE
By the end of this course the learners should be able to:

1. Describe Digester Feedstock
2. Demonstrate Biochemical Processes
3. Explain Digester and Biogas

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to biogas technology
1.1 Definition and the biogas resource;
1.2 Importance/Benefits of Biogas;
1.3 How biogas is formed;
1.4 Conditions required for formation of biogas;
1.5 Biogas composition and properties;
1.6 Challenges of biogas technologies

CHAPTER TWO
2.0 Digester Feedstock
2.1 Feedstock preparation
2.2 Rate of feed,
2.3 Retention time and disposal;

CHAPTER THREE
3.0 Biochemical Processes
3.1 Conditions for formation of biogas
3.2 Bacteria involved in the formation of biogas
3.3 Stage involved in the formation of biogas
3.4 Digestion control and optimization

CHAPTER FOUR
4.0 Digester
4.1 Types of digesters
4.2 Digester designs
4.3 Digester constructions and operation

CHAPTER FIVE

5.0 Biogas

5.1 Characteristics and properties of biogas

5.2 Biogas utilization

5.3 Gas cleaning and conditioning.

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Biogas & Engines, www.clarke-energy.com, Accessed 21.11.11
2. State Energy Conservation Office (Texas). "Biomass Energy: Manure for Fuel.", 23 April 2009. Web. 3 October 2009.
3. Gupta, Sujata (6 November 2010). "Bio gas comes in from the cold". New Scientist (London: Sunita Harrington). p. 14. Retrieved 4 February 2011.
4. "Biogas - Bioenergy Association of New Zealand (BANZ)". Bioenergy.org.nz. 29 November 2006. Retrieved 21 February 2010.
5. Safety Page, Beginners Guide to Biogas, www.adelaide.edu.au/biogas. Retrieved 22.10.07.
6. Basic Information on Biogas, www.kolumbus.fi. Retrieved 2.11.07.
7. Richards, B.; Herndon, F. G.; Jewell, W. J.; Cummings, R. J.; White, T. E. (1994). "In situ methane enrichment in methanogenic energy crop digesters". Biomass and Bioenergy 6 (4): 275–274. doi:10.1016/0961-9534(94)90067-1. edit
8. Richards, B.; Cummings, R.; White, T.; Jewell, W. (1991). "Methods for kinetic analysis of methane fermentation in high solids biomass digesters". Biomass and Bioenergy 1 (2): 65–26. doi:10.1016/0961-9534(91)90028-B. edit
9. Tower, P.; Wetzel, J.; Lombard, X. (March 2006). "New Landfill Gas Treatment Technology Dramatically Lowers Energy Production Costs". Applied Filter Technology. Retrieved 30 April 2009
10. *Increased Greenhouse Gas Emissions', Food and Agricultural Organization of the United Nations*
11. State Energy Conservation Office (Texas). "Biomass Energy: Manure for Fuel."
12. Webber, Michael E and Amanda D Cuellar. "Cow Power. In the News: Short News Items of Interest to the Scientific Community." Science and Children os 46.1 (2008): 13. Gale. Web. 1 October 2009 in United States.

24.3 COMMUNICATION SKILLS

COURSE CODE **DRE 1203**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION

This course introduces students to the basics of communication especially the desirable skills that help students in the world of work. Letter writing skills are also covered in detail.

LEARNING OUTCOMES

By the end of this course, students should be able to communicate effectively to teammates and the public.

OBJECTIVES OF THE COURSE

By the end of this course the student should be able to:

1. Demonstrate the ability to communicate efficiently and effectively
2. Deal with correspondences and other writings at a supervisory level
3. Understand the meaning of communication and how it relates to other management functions.
4. Use of both verbal and non-verbal communication
5. Acquire public presentation skills
6. Acquire writing skills of business letters, memos and minutes of a meeting.

COURSE CONTENT

CHAPTER ONE

1.0. Grammar and vocabulary
1.1. Parts of speech
1.2. Tenses
1.3. Simple and Compound Sentences
1.4. Punctuation
1.5. Direct and Indirect Speech
1.6. Prefixes and suffixes
1.7. Correction of grammatical errors

CHAPTER TWO

1.0 Comprehension
1.1 Summary writing
1.2 Written and oral deduction of summons from given prose passage
1.3 Diction
1.4 Answering questions about the passage

CHAPTER ONE

3.0 Introduction
3.1 Meaning of communication
3.2 The communication process and its elements
3.3 Importance of communication
3.4 Types of communication; oral, verbal and non-verbal etc.
3.5 Barriers to communication
3.6 Remedies to barriers of communication
3.7 Principles of business communication

CHAPTER TWO

4.0 Organizational communication

4.1 Introduction
4.2 Communication structures
4.3 Communication networks
4.4 Channels of communication
4.4.1 Downward channels
4.4.2 Upward channels
4.4.3 Horizontal communication
4.4.4 Grape vine communication
4.4.5 Diagonal communication

CHAPTER THREE

5.0 Written communication

5.1 Introduction
5.2 Advantages and disadvantages of written communication
5.3 Business letter writing; CV writing, Application letter writing, requisition writing, apology writing, memo writing, delegation letters, official circulars, recommendation letters and notices
5.3.1 Parts of the business letter, types/formats of letters

CHAPTER FOUR

6.0 Report writing

6.1 Definition of a report
6.2 Importance of reports
6.3 Types of reports
6.4 Limitations of reports in organizations and solutions

CHAPTER FIVE

7.0 Oral communication

7.1 Introduction
7.2 Advantages and disadvantages of oral communication
7.3 Listening
7.3.1 Meaning of listening
7.3.2 Listening process
7.3.3 Types of listening
7.3.4 Preparation for listening
7.3.5 Importance of listening
7.3.6 Listening skills
7.3.7 Barriers to effective listening
7.4 Public speaking
7.4.1 Types of public speaking
7.4.2 Preparation/principles
7.4.3 Stage flight
7.5 Negotiating
7.6 Telephones
7.6.1 How to use a telephone
7.6.2 Advantages and disadvantages of telephones

CHAPTER SIX

8.0 Non-verbal communication

8.1 Meaning of non verbal communication
8.2 Relationship between verbal and non verbal communication
8.3 Importance of non verbal communication
8.4 Divisions of non verbal communication

8.4.1 Social
8.4.2 Physical (gestures, facial, expression, eyes etc)
8.4.3 Environment; room design, Buildings etc
8.5 Problems of non verbal communication and their suggested solutions

CHAPTER SEVEN

9.0 **Meetings**
9.1 Meaning of meetings
9.2 Types of meetings
9.3 Preparation for meetings
9.4 Documents and terminologies used in meetings.
9.5 Notices, Agenda, minutes etc
9.6 Roles of different personnel
9.7 Advantages and disadvantages of meetings
9.8 Committees
9.9 Formation and types of committees
9.10 Advantages and disadvantages of committees
9.11 Handling committee business

CHAPTER EIGHT

10.0 Interviews
10.1 Definition of interviews
10.2.1 Parties involved in the interview
10.2.2 Roles of different parties involved in the interview
10.3 Methods or types of interviews

CHAPTER NINE

11.0 Practical participation
11.1 Use of aids in:-
11.1.1 Oral presentation
11.1.2 Meetings
11.1.3 Interviews and committee sittings

CHAPTER TEN

12.0 Advertising
12.1 Definition of advertising
12.2 How to design an advert
12.3 Modes of advertising (radio, newspapers, magazines, internet, signposts etc.)

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. G J.BWaswaBalumywa, Getting the message around
2. J.S. Chandan Management, concepts and strategies
3. Chester L. Wolford and Vanneman E. (1983) Business Communications Edward Arnold, London

24.4 HYDRO ENERGY I

COURSE CODE **DRE 1204**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION
This course introduces students to the hydro power, preliminary measurements and the necessary civil works involves for hydropower stations.

LEARNING OUTCOME
Students will be able to identify different types of hydro power plants, preliminary measurements and the necessary civil works involves for hydropower stations

OBJECTIVES OF THE COURSE
By the end of this course students should be able to deal with

1. Hydrological site Measurements
2. Water diversions civil works,
3. Dams and barrages,
4. Diversion and intake works

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to hydropower plants
1.1 General features of water power,
1.2 Potential and developed hydropower sources (world and regional).
1.3 Categorization of hydropower plants,
1.4 Hydropower planning.

CHAPTER TWO
2.0 Hydrological Site measurements
2.1 Hydrologic cycle,
2.2 Data acquisition,
2.3 Rainfall
2.4 Discharge measurements
2.5 Power duration curves
2.6 Firm power
2.7 Discharge and head
2.8 Estimation of a flow duration curve
2.9 Design flow
2.10 Determination of power and energy potential.
2.11 Site selection and layout

CHAPTER THREE
3.0 Water diversions civil works,
3.1 Fore bay,
3.2 Water conveying structures
3.3 Penstocks
3.4 Gates

3.5 Valves
3.6 Tailrace
3.7 Sediment problems
3.7 Settling tanks.

CHAPTER FOUR
4.0 Dams and barrages
4.1 Classification of dams
4.2 Planning of dams
4.3 Concrete Dams and types of concrete dams
4.4 Spillways, classification, types of spillways
4.5 Weirs
4.6 Side channel
4.7 Siphon and shaft types.

CHAPTER FIVE
5.0 Diversion and intake works
5.1 Trash racks
5.2 Water conveyance structures
5.3 Canals
5.4 Pressure tunnels penstocks
5.5 Water hammer surge chambers.

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES
1. "History of Hydropower". U.S. Department of Energy.
2. Hydroelectric Power". Water Encyclopedia.
3. Maynard, Frank (November 1910). "Five thousand horsepower from air bubbles". *Popular Mechanics*: Page 633.

24.5 BASIC ELECTRONICS

COURSE CODE **1205**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the basic knowledge and skills in electronics management.

LEARNING OUTCOMES
Students will be able to be able to apply the science of electronics in the field of work Illustration of the band theory, intrinsic semi-conductors and extrinsic semi-conductors (P-type and N-type semi-conductors).

OBJECTIVES OF THE COURSE
By the end of the course, students should be able to
1. Identify behaviour of electronic conductors, semi-conductors and insulators.
2. Basic concepts and definition of electronics, relevance of electronic and solid-state
3. Design and construct of the three regions of a BJT as current amplifier, voltage amplifier or power amplifier.
4. Illustration of the band theory, intrinsic semi-conductors and extrinsic semi-Conductors (P-type and N-type semi-conductors).

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Electronics
1.1 Basic concepts and definition of electronics, relevance of electronic and solid-state electronics.

CHAPTER TWO
2.0 The Science of Electronic Materials
2.1 Behaviour of electronic conductors, semi-conductors and insulators.
2.2 Electrical conductivity of these materials and their variance with increasing thermal energy.
2.3 Illustration of the band theory, intrinsic semi-conductors and extrinsic semi-conductors (P-type and N-type semi-conductors)

CHAPTER THREE
3.0 P-N Junction and its Application
3.1 Diffusion process across the P-N junction, barrier potential difference, biasing of P-N junctions breakdown, P-N diodes and their characteristics, types (such as power diodes, signal diodes, light emitting diodes, Zenner diodes, Varactor diodes, PIN diodes, Photodiodes, etc.) and their applications. The rectification process, as one application of diodes and how a regular stabilised DC power supply can be obtained.

CHAPTER FOUR

4.0 The Bipolar Junction Transistors (BJTs)

4.1 Design and construction of the three regions of a BJT (emitter, base and collector), biasing of BJTs, application of BJTs as amplifiers). The three BJTs configurations in circuits (common emitter, common base, common collector), the BJT as current amplifier, voltage amplifier or power amplifier.

CHAPTER FIVE

5.0 Digital Electronic Circuits

5.1 Comparison of digital and analogue electronics and systems, review of the numbering systems (octal, binary and hexadecimal).

5.2 Boolean algebra and using Boolean algebra to evaluate complex expressions by employing truth tables.

5.3 The basic logic gates (AND OR, and NOT) INVERTER, the analysis of logic circuits, logic theorems and their application in simplifying complex logic problems.

5.4 The universal logic gates (NAND and NOR), design of logic circuits to implement simple solutions for explained logic problems.

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Allan R. Hambley *Electrical Engineering*, pp. 3, 441, Prentice Hall, 2004 ISBN 978-0-13-147046-0
2. *Principles of Electrical Engineering*. Books.google.com. Retrieved 2012-10-29.
3. Anthony J. Pansini *Electrical Distribution Engineering*, p. xiv, The Fairmont Press Inc., 2006 ISBN 978-0-88173-546-8
4. Smarajit Ghosh *Fundamentals of Electrical and Electronic Engineering*, p. xxi, PHI Learning Pvt. Ltd., 2004 ISBN 978-81-203-2316-2
5. Erik Barnouw *A Tower in Babel*, p. 28, Oxford University Press US, 1966 ISBN 978-0-19-500474-8
6. *Radio Engineering Principles*. Books.google.com. Retrieved 2012-10-29.
7. Charles A. Harper *High Performance Printed Circuit Boards*, pp. xiii-xiv, McGraw-Hill Professional, 2000 ISBN 978-0-07-026713-8
8. Rakesh K. Garg/Ashish Dixit/Pavan Yadav *Basic Electronics*, p. 1, Firewall Media, 2008 ISBN 978-81-318-0302-8
9. Sachin S. Sharma *Power Electronics*, p. ix, Firewall Media, 2008 ISBN 978-81-318-0350-9
10. Edward J. Rothwell/Michael J. Cloud *Electromagnetics*, CRC Press, 2001 ISBN 978-0-8493-1397-4
11. Joseph Edminister Schaum's Outlines *Electromagnetics*, McGraw Hill Professional, 1995 ISBN 978-0-07-021234-3

24.6 COMPUTER APPLICATIONS II

COURSE CODE **DRE 1206**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION

This course enables students to acquire basic knowledge and skills in MS Access, MS Power Point and Internet.

LEARNING OUTCOMES

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

1. Create databases using Microsoft Access.
2. Make presentations using Microsoft Power point
3. Use search engines to obtain academic and other information

OBJECTIVES

By the end of this course learners should be able to:

1. Identify the different Applications within an Office environment
2. Acquire skills in basic computer software applications and apply them in various business situations in order to facilitate the information management function.
3. Appreciate computer applications in business through hands on
4. Demonstrate the ability to use the common software applications of Microsoft Word, and Microsoft Excel
5. Produce business documents and data analysis and models applicable to business environment

COURSE CONTENT

CHAPTER ONE

1.0 Database Management (Microsoft Access)

1.1 Starting MS Access
1.2 Creating data bases
1.3 Crating data tables; Using design view, table wizard, by entering data
1.4 Creating relationships between tables
1.5 Creating forms; using form wizard
1.6 Creating queries; using design view, using query wizard
1.7 Sorting and filtering data
1.8 Formatting data in different objects
1.9 Generating reports using report wizard
1.10 printing
1.11 Practice assignments

CHAPTER TWO

2.0 Presentation management (Microsoft point)

2.1 Starting MS Power Point
2.2 Starting a slide presentation and selecting the slides of desire
2.3 Formatting slides in the slide sorter
2.4 Adding coloring to slides

2.5 Graphing in the slides
2.6 Formatting slide show for different slide designs, layouts and animation schemes
2.7 Viewing a slide show
2.8 Saving and printing the slide presentation
2.9 Practice assignments

CHAPTER THREE

3.0 Internet/Intranet

3.1 Internet definition
3.2 History of Internet
3.3 Uses of Internet
3.4 ISP (Internet Service Providers)
3.5 DNS (Domain Name Systems)
3.6 www (World Wide Web)
3.7 Internet Browsers and Search Engines; Google Chrome, Internet Explorer, Mozira Firefox, OPERA
3.8 URL(Uniform Resource Locator)
3.9 Web Portals
3.10 Navigator/Bookmarks/links
3.11 Uploading and Downloading
3.12 Webmail (Electronic Mails); Thunderbird, Outlook.
3.13 Working with news groups
3.14 Printing and Saving Documents
3.15 Social Networking Web: Facebook, Twiter, Google, Yahoo messenger (chart room),
3.16 http: (hypertext Transfer Protocal)
3.16 Creating a homepage
3.17 Internet Security; Virus Infection, Firewalls, Open source programmes (Thunderbird, Outlook Google Chrome, Internet Explorer, Mozira Firefox, OPERA)

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Kathy Ivens and Thomas Barich(1997), How to use Microsoft Office' 97, Ziff-Davis press
2. Whitecomb A and Brown B, Key boarding and Document production, Stanley Thornes, **Chem.: emam**
3. E.S. Waburoko(200), An introduction to information technology, Department to Distance Learning, Edsoft Computer Institute
4. Teach yourself Microsoft Excel 97 in 24 Hours by Linda Jones and Reul L. Hernadez by S: MS
5. Hernandez cy SAW Publishing
6. Keneth C. and Laudon J.P: Essentials of Management Information Systems; 3rd Edition Prentice Hall, New Jersey, 1999
7. Elliot G. and Starkings:Business Information Technology, Theory and Practice; Addison Wesley, Longman, London and New York, 1998
8. Olive and Chapman; Data Processing and Information Technology, DP Publications
9. Christopher Barnatt (1996): Management Strategy; ND Information Technology; International Thomson Business Press.
10. Clifton H.D. and A.G. (1994); Business Information Systems; 5th Edition.
11. Raymond McLeod J (1995): Management Information Systems; 6th Edition; Prentice Hall International Editions.

24.7 RENEWABLE ENERGIES PROJECT II

COURSE CODE **DRE 1207**

CREDIT UNITS **05**

CONTACT HOURS **75**

PROJECT DESCRIPTION
This project involves site identification and analysis, design/sizing of parts, installation, generation, conservation & utilization.

LEARNING OUTCOMES
Students will be able to generate and utilize mechanical power, Install and generate power, Carry out environmental impact assessment.

OBJECTIVES OF THE COURSE
By the end of this course, the learner should be able to:
1. Research and survey
2. Select site.
3. Carry out environmental impact assessment
4. Determine energy demand.
5. Identify power generation equipment.
6. Install and generate power
7. Determine power rating
8. Commission the power plant
9. Distribute power
10. Generate sustainable constant power
11. Prepare project reports

PROJECT ACTIVITIES
a). Fabrication and powering a maize mill using solar power or fuel generator
b). Honey squeezing machine.
c). Cooking oil squeezing machine

Innovation: Student's self initiated project relevant to the programme.

MODE OF DELIVERY
The methods of instruction will include demonstration, group discussions and presentation

ASSESSMENT OF THE COURSE
This course unit will be assessed on 100 marks as follows:

Project Assessment 1	20%
Project Assessment 2	20%
Student's Personal Innovation	20%
Project Assessment 4	40%
Total	**100%**

The marks will be converted into Grade points.

24.8 FIELD WORK

Course Code **DRE 1208**

Credit units 05

Contact hours 75

COURSE DESCRIPTION
This course introduces students to transform the knowledge and skills obtained in class into real practical job performance.

LEARNING OUTCOMES
Student should be able to acquire the skills of working with others in a given organization and put into practice what was studied in class.

OBJECTIVES OF THE COURSE
By the end of this course students should be able to:
1. Familiarize themselves with workplace environment
2. Translate what was learnt in class into real life situation
3. Acquire more job competences.
4. Market themselves to prospective employers through demonstration of skills.

COURSE CONTENT
1. Intern orientation to the workplace
2. Planning, identifying and scheduling of industrial training tasks and activities
3. Working under the guidance of the industrial training organization supervisor
4. Visitation by the training institution supervisor to share the experiences and challenges facing the intern.

MODE OF DELIVERY
The mode of delivery will include; practice, demonstration and supervision.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Industrial Training

1. Training institution supervisor	10%
2. Workplace supervisor's assessment	30%
3. Intern's report	30%
Subtotal	**70%**
Study Tours	**30%**
Total	**100%**

The marks will be converted to grade points.

25.0 YEAR TWO SEMESTER ONE

25.1 BIOMASS THERMO-CHEMICAL TECHNOLOGIES

COURSE CODE **DRE 2101**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the necessary knowledge and basic skills about biomass thermo-chemical energy conversion systems and related technologies

LEARNING OUTCOME
Students will be able to understand the principle behind thermo-chemical conversion technologies and systems,

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to:

1. Identify combustion processes; Combustion based systems (technologies) and applications
2. Describe Gasification and Producer gas
3. Explain Liquefaction processes, technologies and applications; Uses of bio-oil

CHAPTER ONE
1.0 Introduction to thermo-chemical processes
1.1 Definition of Thermo-chemical processes
1.2 Thermo-chemical processes such as combustion; gasification; pyrolysis; and liquefaction

CHAPTER TWO
2.0 Combustion processes
2.1 The mechanism of combustion
2.2 Combustion systems such as; fluidized bed systems, industrial furnaces and domestic combustion systems (charcoal and firewood stoves)

CHAPTER THREE
3.0 Gasification
3.1 Description of gasification process such as Drying of fuel, Pyrolysis, Combustion and Reduction
3.2 Types of Gasifiers such as downdraft, updraft, cross-flow and fluidized bed gasifiers;
3.3 Challenges of gasification

CHAPTER FOUR
4.0 Producer gas
4.1 characterization of producer gas
4.2 Gas Cleaning
4.3 Conditioning/treatment and utilization of producer gas such as in gas turbines and IC engines; domestic cooking and lighting; etc.

CHAPTER FIVE

5.0 Liquefaction

5.1 Definition of Liquefaction

5.2 Types of liquefaction processes such as direct liquefaction; indirect liquefaction, catalytic liquefaction

5.3 Products of liquefaction processes.

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. National Non-Food Crops Centre. "NNFCC Renewable Fuels and Energy Factsheet: Anaerobic Digestion", Retrieved on 2011-02-16
2. Biogas & Engines, www.clarke-energy.com, Accessed 21.11.11
3. Claverton Energy Conference, 24 October 2009, Bath, UK
4. State Energy Conservation Office (Texas). "Biomass Energy: Manure for Fuel.", 23 April 2009. Web. 3 October 2009.
5. Be Green - Make Gas
6. Gupta, Sujata (6 November 2010). "Bio gas comes in from the cold". New Scientist (London: Sunita Harrington). p. 14. Retrieved 4 February 2011.
7. "Biogas - Bioenergy Association of New Zealand (BANZ)". Bioenergy.org.nz. 29 November 2006. Retrieved 21 February 2010.

25.2 SOLAR THERMAL TECHNOLOGIES

COURSE CODE **DRE 2102**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduce students to the solar energy, necessary knowledge and basic skills about solar thermal systems and technologies

LEARNING OUTCOMES
Students will be able to know solar energy resource and understood solar thermal systems and technologies.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to

1. Explain Solar thermal conversion principles
2. Identify Materials for solar thermal systems and their properties
3. Describe Solar collectors
4. Demonstrate Solar thermal applications

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Solar energy
1.1 Origin of solar energy
1.2 Solar radiation principles
1.3 Solar geometry
1.4 Global energy flows
1.5 Types of radiation
1.6 Insolation
1.7 Solar radiation measuring techniques and dat
1.8 Solar Energy Mapping
1.9 Current and future potential of solar energy.

CHAPTER TWO
2.0 Solar thermal conversion principles

CHAPTER THREE
3.0 Materials for solar thermal systems and their properties
3.1 Heat transfer materials
3.2 Absorber surfaces
3.3 Glazing
3.4 Insulating materials

CHAPTER FOUR
4.0 Solar collectors
4.1 Flat plate collectors,
4.2 Concentrators,

4.3 Evacuated tubes
4.4 Solar Tracking
4.5 Solar thermal energy storage

CHAPTER FIVE
5.0 Solar thermal application
5.1 Water heating
5.2 Drying
5.3 Cooking
5.4 Cooling
5.5 Electricity - solar tower, trough and lenses

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Norton, Brian (2013). *Harnessing Solar Heat*. Springer. ISBN 978-94-007-7275-5.
2. Runyon, Jennifer (2011). "Solar Shakeout Continues: Sterling Energy Systems Files for Chapter 7 Bankruptcy". *renewableenergyworld.com*. Retrieved November 14, 2011.
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25.3 THERMODYNAMICS

COURSE CODE **DRE 2103**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the basic concepts of thermodynamics and gas laws, Laws of Thermodynamics and Processes, Formation of steam and its properties, Power cycles, Fuels and combustion.

LEARNING OUTCOMES
Students will be able to describe the various thermodynamic processes determines the thermal efficiencies, mean effective pressure of the gas power cycles, and the knowledge in design of power producing plants and optimal utilization of energy resources

OBJECTIVES OF THE COURSE
By the end of this course, the students should be able to:
1. Describe Thermodynamics, property, system (open and closed), surroundings, heat and work, and specific heat.
2. Describe and apply Gas laws: Boyle's law, Charles's law.
3. Derive and apply Characteristics gas equation.
4. Apply gas constant, universal gas constant and joules law.
5. Describe and apply the Zeroth, first and second Laws of thermodynamics.
6. Describe Claudius and Kelvin Plank statements of second law of thermodynamics.
7. Calculate the thermal efficiencies, the work ratio of the gas and steam power cycles.
8. Measure the Calorific values-Lower and higher.

COURSE CONTENT
CHAPTER ONE
1.0 Basic Concepts and Gas Laws
1.1 Gas laws: Boyle's law, Charles's law.
1.2 Characteristics equation, gas constant, universal gas constant.
1.3 Thermodynamics, property, system (open and closed), surroundings, heat and work, and specific heat.

CHAPTER TWO
2.0 Laws of Thermodynamics and Processes
2.1 Explanation of the Zeroth law of thermodynamics and the first Law of thermodynamics.
2.2 Concept of enthalpy, internal energy, specific heat, work and heat energies
2.3 Claudius and Kelvin Plank statements of second law of thermodynamics.
2.4 Concept of entropy, constant volume, constant pressure, isothermal, adiabatic and polytrophic processes, throttling and free expansion and work done under these processes.

CHAPTER THREE

3.0 Formation of Steam and its Properties

3.1 Steam formation.
3.2 Wet steam, dry steam and saturated steam; dryness fraction.
3.3 Super-heated steam; degree of super heat.
3.4 Latent heat of vaporization.
3.5 Temperature entropy diagram, Mollier diagram (H-S diagram)/steam tables

CHAPTER FOUR

4.0 Power Cycles

4.1 Concept of reversibility, Carnot cycle.
4.2 Rankine cycle and its efficiency.
4.3 Brayton cycle (Joule cycle).
4.4 Otto, diesel and dual combustion cycle.

CHAPTER FIVE

5.0 Fuels and Combustion

5.1 Classification of fuel by state, their characteristics, storage and handling of fuels.
5.2 Calorific values-Lower and higher, measurement
5.3 Combustion- element, molecule, chemical equation and chemistry of combustion.
5.4 Stoichiometric air ratio, Percentage of excess air
5.5 Gravimetric and volumetric analysis of products of combustion

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Clausius, Rudolf (1850). On the Motive Power of Heat, and on the Laws which can be deduced from it for the Theory of Heat. Poggendorff's Annalen der Physik, LXXIX (Dover Reprint).
2. Gibbs, Willard, J. (1876). *Transactions of the Connecticut Academy*, III, pp.
3. 108–248, Oct. 1875 – May 1876, and pp. 343–524, May 1877 – July 1878.
4. Duhem, P.M.M. (1886). *Le Potential Thermodynamique et ses Applications*, Hermann, Paris.
5. Lewis, Gilbert N.; Randall, Merle (1923). Thermodynamics and the Free Energy of Chemical Substances. McGraw-Hill Book Co. Inc.
6. Guggenheim, E.A. (1933). *Modern Thermodynamics by the Methods of J.W. Gibbs*, Methuen, London.
7. Thermodynamics. Longmans, Green & Co., London. Includes classical non-equilibrium thermodynamics.
8. Enrico Fermi (1956). *Thermodynamics*. Courier Dover Publications. p. ix..
9. Perrot, Pierre (1998). A to Z of Thermodynamics. Oxford University Press.

25.4 BIOMASS LIQUID FUEL TECHNOLOGIES

COURSE CODE **DRE 2104**

CREDIT UNITS **03**

CONTACT HOURS **45**

Course description
This course introduces students to the necessary knowledge and skills about biomass liquid fuel energy conversion systems and related technologies

LEARNING OUTCOMES
Students will be able to understand the principle behind liquid fuel conversion technologies and systems.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to

1. Demonstrate Combustion processes, combustion based systems (technologies) and applications
2. Describe Gasification and Producer gas
3. Explain Liquiefaction processes, technologies and applications, uses of bio-oil.
4. Explain Bio-ethanol and Bio-diesel processes

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to biofuel conversion processes
1.1 Definitions
1.2 Classification of bio-fuels;
1.3 Issues concerning bio-fuel production;
1.4 Social political concerns

CHAPTER TWO
2.0 Bio-ethanol
2.1 Sources and their yields;
2.2 Technologies;
2.3 Equipment;
2.4 Process description;
2.5 Hydrated ethanol dehydration;
2.6 Ethanol uses;

CHAPTER THREE
3.0 Bio-diesel:
3.1 Biodiesel sources;
3.2 Production process;
3.3 Equipment/components;

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Safety Page, Beginners Guide to Biogas, www.adelaide.edu.au/biogas. Retrieved 22.10.07.
2. Basic Information on Biogas, www.kolumbus.fi. Retrieved 2.11.07.
3. Juniper Biogas Yield Comparison
4. Richards, B.; Herndon, F. G.; Jewell, W. J.; Cummings, R. J.; White, T. E. (1994). "In situ methane enrichment in methanogenic energy crop digesters". Biomass and Bioenergy 6 (4): 275–274. doi:10.1016/0961-9534(94)90067-1. edit
5. Richards, B.; Cummings, R.; White, T.; Jewell, W. (1991). "Methods for kinetic analysis of methane fermentation in high solids biomass digesters". Biomass and Bioenergy 1 (2): 65–26. doi:10.1016/0961-9534(91)90028-B. edit
6. Tower, P.; Wetzel, J.; Lombard, X. (March 2006). "New Landfill Gas Treatment Technology Dramatically Lowers Energy Production Costs". Applied Filter Technology. Retrieved 30 April 2009.
7. State Energy Conservation Office (Texas). "Biomass Energy: Manure for Fuel."

25.5 GEOTHERMAL ENERGY SYSTEMS

COURSE CODE **DRE 2105**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the geothermal energy and related technologies, worldwide regional and national geothermal energy use and resource.

LEARNING OUTCOMES
Students will be able to explain the geothermal energy and the different types of technologies used to harness it.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to:

1. Demonstrate how Geothermal Energy is Used
2. Explain types of geothermal power plants

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Geothermal energy
1.1 Definition of geothermal energy
1.2 Worldwide, regional and national geothermal energy use and resource
1.3 History of geothermal energy
1.4 Operation of a conventional geothermal reservoir
1.5 Possible impact of climate change on resource potential;
1.6 Environmental and social impacts
1.7 Different ways in which geothermal energy can be used
1.8 Operation of a geothermal power plant

CHAPTER TWO
2.0 How Geothermal Energy is Used
2.1 Electricity generation
2.2 Direct thermal use
2.3 Geothermal Heat Pumps, also called Geo-exchange Units or Ground-Coupled Heat Pumps

CHAPTER THREE
3.0 Types of tidal stream generators
3.1 Types of Geothermal power plants
3.2 Flash steam power plant
3.3 Dry steam power plants
3.4 Binary cycle power plant

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Grant, Malcolm Alister; Bixley, Paul F (1 April 2011). *Geothermal Reservoir Engineering*. Academic Press.
2. Nemzer, J. "Geothermal heating and cooling".
3. William E. Glassley. Geothermal Energy: Renewable Energy and the Environment CRC Press, 2010.
4. Geothermal Energy Association. Geothermal Energy: International Market Update - May 2010, p. 7

25.6 ENGINEERING SOFTWARE

COURSE CODE **DRE 2106**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION

This course introduces students the design of building structures using the computer programmes of Auto and Arch CAD.

LEARNING OUTCOMES

By the end of the course, students will be able to use a computer for designing and drawing building structures and facilities.

OBJECTIVES OF THE COURSE

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

1. Use a computer for designing and drawing building structures and facilities
2. Use AutoCAD and Archi CAD in designing buildings, road sections and other facilities

CHAPTER ONE

1.0 File Management

1.1 Create new files, save a file, Open a file,
1.2 Export, Publish, Recover
1.3 Send, Publish

CHAPTER TWO

2.0 Drawing

2.1 Creation of layers
2.2 Line ray, construction line, multi line
2.3 Polyline, 3D polyline, polygon, Rectangle
2.4 Arch Circle Donut, Ellipse, Spline
2.5 Block, Point
2.6 Hatch, Boundary, Region, Cloud

CHAPTER THREE

3.0 Methods for Viewing Drawing

3.1 Regenerate
3.2 Redraw
3.3 Zoom
3.4 Pan
3.4 Hide, Shade and Render
3.5 Dimension

CHAPTER FOUR

4.0 Dimensioning

4.1 Linear, Aligned, Ordinate
4.2 Radius Diameter Angular
4.3 Baseline, Text, Dimension styles

CHAPTER FIVE

5.0 Modifying a Drawing

5.1 Match Properties, Object, Clip
5.2 Erase, Copy, Offset, Array
5.3 Move Rotate, Scale, Stretch, and Lengthen
5.4 Trim, Extend, Break, Chamfer, Fillet
5.5 3D Operation, Solid Edit,
5.6 Explode

CHAPTER SIX

6.0 Production of Architectural Drawing

6.1 Review of drawing layout: Title block, Notes, Paper sizes,
6.2 Considerations of site orientation, economy, aesthetics, facilities for disabled, fire safety,
6.3 Block plan, Site Plan, Ground plan
6.4 Sections and Elevations
6.5 Details
6.6 Plotting and printing drawing on plain sheets, tracing and ammonia paper

CHAPTER SEVEN

7.0 Facilities details

7.1 Production of Plumbing & drainage drawings details
7.2 Electrical wiring network to lights and circuits

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Narayan, K. Lalit (2008). *Computer Aided Design and Manufacturing*. New Delhi: Prentice Hall of India. p. 3. ISBN 812033342X.
2. Narayan, K. Lalit (2008). *Computer Aided Design and Manufacturing*. New Delhi: Prentice Hall of India. p. 4. ISBN 812033342X.
3. Madsen, David A. (2012). *Engineering Drawing & Design*. Clifton Park, NY: Delmar. p. 10. ISBN 1111309574.
4. Farin, Gerald; Hoschek, Josef and Kim, Myung-Soo (2002). *Handbook of computer aided geometric design [electronic resource]*. Elsevier. ISBN 978-0-444-51104-1.
5. Ross, Douglas T. (17 March 1961). Computer-Aided Design: A Statement of Objectives. MIT USAF 8436-TM-4.

25.7 RENEWABLE ENERGIES PROJECTS III

COURSE CODE **DRE 2107**

CREDIT UNITS **05**

CONTACT HOURS **75**

PROJECT DESCRIPTION
This project involves Selection of troubleshooting methods, dismantling and assembling of machine parts, and repairing component to its proper functioning.

LEARNING OUTCOMES
Students will be able to select the troubleshooting methods, dismantles and assembles machine parts, and repairs component to its proper functioning.

OBJECTIVES OF THE PROJECT
By the end of this course, students should be able to:
1. Identify faults.
2. Interpret operation manuals.
3. Identify materials and consumables.
4. Select of tools and components.
5. Select troubleshooting methods.
6. Dismantle and assemble of machine parts.
7. Sustain constant maintenance of the unit
8. Test and operate.
9. Prepare project reports

PROJECT ACTIVITIES
Maintain machinery and equipment in good working condition: E.g. To overhaul and service petrol and diesel engines

Innovation: Student's self initiated project relevant to the programme

MODE OF DELIVERY
The mode of delivery will include demonstration, group discussions and presentation

ASSESSMENT OF THE COURSE
This course unit will be assessed on 100 marks as follows:

Project Assessment 1	20%
Project Assessment 2	20%
Student's Personal Innovation	20%
Project Assessment 4	40%
Total	**100%**

The marks will be converted into Grade points.

26.0 YEAR TWO SEMESTER TWO

26.1 POWER TRANSMISSION SYSTEMS

COURSE CODE **DRE 2201**

CREDIT UNITS **05**

CONTACT HOURS **75**

COURSE DESCRIPTION
This course introduces students to the Automotive Power Transmissions, Pneumatic Power Transmissions, Automatic Transmission, Stationary Plant Power Transmissions, Friction Drives, Bearings, and Other Power transmission systems.

LEARNING OUTCOMES
Students will be able select the troubleshooting methods, dismantles and assembles power transmission systems. And know the practical skills to work on the various power transmission systems.

OBJECTIVES OF THE COURSE
By the end of this course, the student should be able to:
1. Describe different types of frictional clutches, manual gear boxes**,** hydrokinetic couplings and torque converters.
2. Compute force, torque and power transmitted.
3. Describe couplings and shafts.
4. Describe belt-drives, chain-drives, brakes and variable speeds control.
5. Describe applications, types and properties of bearings.
6. Describe electric motors, pressure transmission compressors and compressed air systems.

COURSE CONTENT

CHAPTER ONE
1.0 Automotive Power Transmissions
1.1 Friction clutches.
1.2 Centrifugal and semi-centrifugal clutches.
1.3 Construction details of single plate and multiple plate.
1.4 Manual gearboxes.

CHAPTER TWO
2.0 Pneumatic Power Transmissions
2.1 Hydrokinetic fluid couplings and torque converters.
2.2 Components of fluid couplings.
2.3 Computation of torque capacity.
2.4 Hydraulic torque converter.
2.5 Components, efficiency.

CHAPTER THREE
3.0 Automatic Transmission
3.1 Bearings, drivelines and differential gears.

CHAPTER FOUR
4.0 Stationary Plant Power Transmissions
4.1 Couplings and shafts.

CHAPTER FIVE

5.0 Friction Drives
5.1 Belt-drives, Chain-drives, brakes and variable speeds control.

CHAPTER ONE
1.0 Bearings
1.1 Applications.
1.2 Types.
1.3 Properties.

CHAPTER SEVEN
7.1 Other Power transmission systems
7.2 Electric motors, pressure transmission compressors and compress supply systems.

CHAPTER EIGHT
8.0 Practical work
8.1 Practical work on the various Power transmission systems.

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE
This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Buczynski, Beth (23 August 2012). "Power to Gas Technology Turns Excess Wind Energy into Natural Gas". Revmodo.com. Archived from the original on 2012-10-05.
2. Operating Reserves and Wind Power Integration: An International Comparison. National Renewable Energy Laboratory, p. 11.
3. Bullis, Kevin. "Wind Turbines, Battery Included, Can Keep Power Supplies Stable" Technology Review, 7 May 2013. Accessed: 29 June 2013.

26.2 SOLAR PHOTOVOLTAIC TECHNOLOGIES

COURSE CODE **DRE 2202**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the necessary knowledge, skills, and technologies about solar cells, panels and arrays and solar PV technologies

LEARNING OUTCOMES
Students will be able to install and manage solar cells, panels, arrays and solar PV technologies and systems.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to,
1. Describe PV systems components
2. Install the PV systems
3. Manage the PV systems
4. Demonstrate the understanding of PV applications

COURSE CONTENT

CHAPTER ONE
1.0 Solar PV units
1.1 Working principle of solar cells;
1.2 Types of solar cells; cell, module and array;
1.3 Production of wafers, cells and modules;

CHAPTER TWO
2.0 PV systems components
2.1 Modules,
2.2 Controllers,
2.3 Inverters,
2.4 Batteries,
2.5 Appliances
2.6 Balance of system

CHAPTER THREE
3.0 PV systems management
3.1 PV systems sizing
3.2 Installation
3.3 Maintenance
3.4 troubleshooting

CHAPTER FOUR
4.0 PV application
4.1 Grid connected systems
4.2 Solar home systems
4.3 Communication systems

4.4 Water pumping systems
4.5 Consumer products
4.6 Rural electrification systems

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Rahmani, R.; Fard, M.; Shojaei, A.A.; Othman, M.F.; Yusof, R., A complete model of stand-alone photovoltaic array in MATLAB-Simulink environment, 2011 IEEE Student Conference on Research and Development Sustainable Sources. "Photovoltaic Systems".
2. Sustainable Sources.El-Sharkawi, Mohamed A. (2005). *Electric energy*. CRC Press. pp. 87–88. ISBN 978-0-8493-3078-0.
3. M.P. Brennan, A.L. Abramase, R.W. Andrews, J. M. Pearce, Effects of spectral albedo on solar photovoltaic devices, *Solar Energy Materials and Solar Cells*, 124, pp. 111-116,Z.
4. Dereli, C. Yücedağ and J. M. Pearce, Simple and Low-Cost Method of Planning for Tree Growth and Lifetime Effects on Solar Photovoltaic Systems Performance, *Solar Energy*, 95, pp.300-307 (2013). Available: http://www.academia.edu/4074627/Simple_and_low-
5. Pearce, Joshua. M; Adegboyega Babasola, Rob Andrews (2012). "Open Solar Photovoltaic Systems Optimization". *Proceedings of the 16th Annual National Collegiate Inventors and Innovators Alliance Conference* (NCIIA): 1–7.
6. P. Derewonko and J.M. Pearce, “Optimizing Design of Household Scale Hybrid Solar Photovoltaic + Combined Heat and Power Systems for Ontario”, Photovoltaic
7. Regan Arndt and Dr. Ing Robert Puto. Basic Understanding of IEC Standard Testing For Photovoltaic Panels. Available: http://tuvamerica.com/services/photovoltaics/ArticleBasicUnderstandingPV.pdf"Solar photovoltaics: Competing in the energy sector".

26.3 ENTREPRENEURSHIP SKILLS

COURSE CODE **DRE 2203**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION
This course introduces students to the basic entrepreneurship skills of starting and running up, spots business opportunities and test them and enterprise for self employment, survey the market for the business ideas.

LEARNING OUTCOMES
Students will be able to start up a business and create self employment,
Identify the current trends of entrepreneurial development and identify the current trends of entrepreneurial development.

OBJECTIVES OF THE COURSE
Students should be able to,
1. Describe entrepreneurship objectives and history
2. Spot business opportunities and test them.
3. Survey the market for the business ideas.
4. Start up a business and create Self employment
5. Identify the legal forms of business.
6. Register a business.
7. Describe Sources Of Capital
8. Carry out the Cost Analysis of an enterprise
9. Manage the accounting books of the business enterprise

COURSE CONTENT

CHAPTER ONE
1.0 Entrepreneurship Development:
1.1 Concepts and definitions
1.2 Entrepreneurship Objectives and Aspects
1.3 Historical context

CHAPTER TWO
2.0 Uganda's Experience
2.1 Comparison with other countries
2.2 Current Trends of business growth
2.3 Barriers to entrepreneurship Development

CHAPTER THREE
3.0 The Entrepreneurship Process:
3.1 Entrepreneurship phases/cycle
3.2 Characteristics of Entrepreneurship
3.3 Spotting business opportunity
3.4 Assembling of essential resources
3.5 Carrying Market survey
3.6 Writing a business plan

CHAPTER FOUR
4.0 Employment creation:
4.1 Self employment.

4.2 Employment and business Policies.
4.3 Programmes for Development.
4.4 Types of businesses; Legal forms of business;
4.5 Business registration procedures.
4.6 Intellectual Property and business innovation
4.7 Sources of Capital to start-ups enterprises.

CHAPTER FIVE

5.0 Making new ventures:

5.1 Marketing approaches
5.2 Developing marketing plan
5.3 Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis

CHAPTER SIX

6.0 Managing a business enterprise:

6.1 Strategic Management
6.2 Communication in Business
6.3 Building success in an enterprise.
6.4 How the Business can Fail
6.5 How to prevent business failure
6.6 How to attract Customers
6.7 Saving and Reinvestment
6.8 Business relationship with family and Friends

CHAPTER SEVEN

7.0 Financial Management and Cost Accounting Systems:

7.1 Cost Analysis and Control; Methods of cost control.
7.2 Accounting; managing business account books. purpose of record keeping, role accounting statements, basic accounting methods (cash and accrual)
7.3 Taxation; effects of taxation on economic growth, role of taxes, knowing taxes to pay.

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Dana, Leo Paul 2010, “Nunavik, Arctic Quebec: Where Co-operatives Supplement Entrepreneurship,” Global Business and Economics Review 12 (1/2), January 2010, pp. 42–71.
2. Deakins, D.; Freel, M. (2009). *Entrepreneurship and Small Firms*, 5th Edition. McGraw Hill.
3. James W. Halloran. (2014). Your Small Business Adventure: Finding Your Niche and Growing a Successful Business. ALA/Huron Street Press. ISBN 978-1-937589-44-8.
4. Minniti, M. and Moren, L. (2010). "Entrepreneurial types and economic growth", *Journal of Business Venturing*, 25 (3): 305-314.

26.4 HYDRO POWER II

COURSE CODE **DRE 2204**

CREDIT UNITS **04**

CONTACT HOURS **60**

COURSE DESCRIPTION
This course introduces students to the fluid or hydraulic turbines and Fluid or hydraulic electrical devices and machines

LEARNING OUTCOMES
Students will be able to fix and manage the fluid or hydraulic electrical devices and machines

OBJECTIVES OF THE COURSE
By the end of this course, the learner should be able to:
a. Fix fluid or hydraulic turbines
b. Manage Fluid or hydraulic electrical devices and machines
c. Demonstrate Turbine specification,

COURSE CONTENT

CHAPTER ONE
1.0 Fluid or hydraulic turbines
1.1 Turbine capacities and or categories – low and high head turbines,
1.2 Types of Turbines such as; impulse and reaction turbines, cross flow turbines,
1.3 Options for coupling.
1.4 Turbine specification,
1.5 Selection of turbines

CHAPTER TWO
2.0 Fluid or hydraulic electrical devices and machines
2.1 Synchronous and asynchronous Generators
2.2 Voltage regulators
2.3 Phase frequency and control
2.4 Switch gear and protection equipment
2.5 Governing
2.6 Inverters
2.7 Power transmission

CHAPTER THREE
3.0 Power House
3.1 Switch room,
3.2 Battery room,
3.3 Control room.

MODE OF DELIVERY
The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.
There will be the final examination in the last two weeks of the semester.

REFERENCES

1. "History of Hydropower". U.S. Department of Energy.
2. Hydroelectric Power". Water Encyclopedia.
3. Maynard, Frank (November 1910). "Five thousand horsepower from air bubbles". *Popular Mechanics*: Page 633.

26.5 WIND ENERGY

COURSE CODE **DRE 2205**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the wind power & related technologies, Wind Turbine drive trains technologies and Wind Energy measurement and Analysis

LEARNING OUTCOMES
The learners will be to fix and manage wind energy turbines and other components and the different types of technologies and be able to generate power.

OBJECTIVES OF THE COURSE
By the end of this course, students should be able to:

1. Identify wind energy measurement and analysis
2. Describe Wind Turbines Topologies
3. Fix and manage Wind Turbine drive trains technologies
4. Fix and manage Wind Turbine Generators
5. Generate power using wind energy
6. Use wind energy to pump water

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to wind energy
1.1 History of wind power
1.2 Regional wind resources
1.3 Energy from the wind
1.4 Characteristics of wind

CHAPTER TWO
2.0 Wind Energy measurement and Analysis
2.1 The Betz model
2.2 Raleigh wind distribution

CHAPTER THREE
3.0 Wind Turbines Topologies
3.1 Rotor axis orientation: horizontal or vertical;
3.2 Rotor position: upwind or downwind of tower;
3.3 Rotor speed: fixed or variable;
3.4 Hub: rigid, teetering gimbaled or hinged blades;
3.5 Rigidity: still or flexible;
3.6 Number of blades: one, two, three or even more;
3.7 Power control: stall, pitch, yaw or aerodynamic surfaces;
3.8 Yaw control: active or free.

CHAPTER FOUR

4.0 Wind Turbine drive trains technologies

4.1 Conventional: gearbox and high speed generator with few pole pairs.

4.2 Direct drive: any drive train without a gearbox and low speed generator with many pole pairs.

4.3 Hybrid: any drive train with a gearbox and the generator speed between the above two types.

4.4 Multiple generators: any drive train with more than one generator

CHAPTER FIVE

5.0 Wind Turbine Generators

5.1 DC Generator Technologies

5.2 AC Synchronous Generator Technologies

5.3 AC Asynchronous Generators

5.4 Switched Reluctance Generator Technologies

CHAPTER SIX

6.0 Application of wind energy

6.1 Electricity generation

6.2 Water pumping

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Robert Gasch, Jochen Twele (ed.), *Wind power plants. Fundamentals, design, construction and operation*, Springer 2012
2. Erich Hau, *Wind turbines: fundamentals, technologies, application, economics* Springer, 2013 (preview on Google Books)
3. Siegfried Heier, *Grid integration of wind energy conversion systems* Wiley 2006,
4. Peter Jamieson, *Innovation in Wind Turbine Design*. Wiley & Sons 2011,
5. Alois Schaffarczyk (ed.), *Understanding wind power technology*, Wiley & Sons 2014,
6. Hermann-Josef Wagner, Jyotirmay Mathur, *Introduction to wind energy systems. Basics, technology and operation*. Springer 2013,

26.6 TIDAL ENERGY

COURSE CODE **DRE 2206**

CREDIT UNITS **03**

CONTACT HOURS **45**

COURSE DESCRIPTION
This course introduces students to the tidal energy and related technologies, enhancement of tides, tidal stream systems.

LEARNING OUTCOMES
Students will be able to explain the tidal energy and the different types of technologies used to harness it

OBECTIVES OF THE COURSE
By the end of this course, learners should be able to:

1. Describe Tidal power Topologies
2. Explain types of tidal stream generators
3. Demonstrate Applications of Tidal Energy (tidal mills; electricity generation)

COURSE CONTENT

CHAPTER ONE
1.0 Introduction to Tidal energy
1.1 Definition of Tide and tidal energy
1.2 Types of tides
1.3 The cause of tides
1.4 History of tidal usage
1.5 Enhancement of tides
1.6 Tidal power range

CHAPTER TWO
2.0 Tidal power Topologies
2.1 Barrage tidal power
2.2 Tidal stream systems
2.3 Tidal Lagoons

CHAPTER THREE
3.0 Types of tidal stream generators
3.1 Horizontal axis turbines
3.2 Vertical axis turbines
3.3 Stingray tidal turbines
3.4 Shrouded tidal turbine)

CHAPTER FOUR
4.0 Applications of Tidal Energy
4.1 Tidal mills
4.2 Electricity generation

MODE OF DELIVERY

The mode of delivery will include: lecture, hands-on, discovery, experiment, demonstration, group discussions and presentation.

ASSESSMENT OF THE COURSE

This course unit will be assessed out of 100 marks as follows;

Course work by continuous assessment	30%
Final examination	70%
Total	**100%**

The marks will be converted into Grade points.

There will be the final examination in the last two weeks of the semester.

REFERENCES

1. Minchinton, W. E. (October 1979). "Early Tide Mills: Some Problems". *Technology and Culture* (Society for the History of Technology) Dorf, Richard (1981). *The Energy Factbook*. New York: McGraw-Hill.Turcotte, D. L.; Schubert, G. (2002). "4". *Geodynamics* (2 ed.). Cambridge, England, UK: Cambridge University Press. pp. 136–137.
2. George E. Williams (2000). "Geological constraints on the Precambrian history of Earth's rotation and the Moon's orbit". *Reviews of Geophysics* **38** (1): 37–60.
3. Douglas, C. A.; Harrison, G. P.; Chick, J. P. (2008). "Life cycle assessment of the Seagen marine current turbine". *Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment*
4. Evans, Robert (2007). *Fueling Our Future: An Introduction to Sustainable Energy*. New York: Cambridge University Press.
5. Chang, Jen (2008), "6.1", *Hydrodynamic Modeling and Feasibility Study of Harnessing Tidal Power at the Bay of Fundy* (PhD thesis), Los Angeles: University of Southern California, retrieved 2011-09-27

26.7 RENEWABLE ENERGIES PROJECTS IV

COURSE CODE **DRE 2207**

CREDIT UNITS **05**

CONTACT HOURS **75**

PROJECT DESCRIPTION
This project involves selection of troubleshooting methods, dismantling and assembling of machine parts, and repairing component to its proper functioning.

LEARNING OUTCOMES
The learner will be able to select the troubleshooting methods, dismantles and assembles machine parts, and repairs component to its proper functioning in the hydraulic system

OBJECTIVES OF THE PROJECT
By the end of this sub-module, students should be able to:
1. Identify of faults.
2. Interpret of operation manuals.
3. Identify of materials and consumables.
4. Select of tools and components.
5. Select of troubleshooting methods.
6. Dismantle and assemble of machine parts.
7. Sustain constant maintenance of the unit
8. Test and operate.
9. Prepare project reports

PROJECT ACTIVITIES
Maintain a hydraulic system and equipment in good working condition: E.g. Repair of fork lift, earth mover hydraulic system, tipping truck and pneumatic brakes.

Innovation: Student's self initiated project relevant to the programme.

MODE OF DELIVERY
Using documentaries, practical and field work

ASSESSMENT OF THE COURSE
This course unit will be assessed on 100 marks as follows:

Project Assessment 1	20%
Project Assessment 2	20%
Student's Personal Project	20%
Project Assessment 4	40%
Total	**100%**

The marks will be converted into Grade points.

27.0 LIST OF LECTURERS AND TECHNICAL STAFF IN THE FACULTY OF ENGINEERING AND TECHNOLOGY

S/N	NAME	QUALIFICATIONS	EXPERIENCE
1	Akankwasa Phionah	B. VOC. STUD. IN TECH. EDUC (KYU)	3 Years
2	Byamukama Denis	B.VOC. STUD. IN TECH. EDUC (KYU)	3 Years
3	Ingabire Charity	B. VOC. STUD. IN TECH. EDUC (KYU)	3 Years
4	Mwanja Grace Charles	B.Sc Engineering (MUK)	28 Years
5	Kinconco Keneth Muhumuza	ODEE (UNEB), Bsc. Educ. KYU	8 Years
6	Twine Usito Bakesigaki	B. Tech. Teacher Educ. (Mech), KYU	3 Years
7	Nyanzi baker	ODEE (UBTEB) (UTC)	2 Years
8	Twinomujuni Naume	DWE, UNEB (UTC)	3 Years
9	Mugerwa Ashirafu	ODME, UBTEB (UTC)	2 Years
10	Muhumuza Merable	ODCE, UNEB (UTC)	3 Years
11	Niwagaba Edwin	ODIP CERAMICS (UNEB)	2 Years
12	Nabasa Philip	CRAFT I & II, CERT. IN PLUMB (UNEB), DWE	4 Years
13	Mbabazi Alex	ODEE (UNEB) CRAFT I & II ELECT INST (UNEB)	9 Years
14	Tugume Vicent	Craft I & II Carpent & Joinery UNEB, CTTE KYU, DCE Kabale Univ	13 Years
15	Arinda Sam	DME UNEB, HDEE City Guilds of London Institutes	4 Years
16	Niwamanya Paison	ODME (UNEB)	2 Years
17	Narinda Ivan	B. Voc Studies in Tech Educ KYU	2 Years
18	Akampurira Keneth	HDME, ODME (UNEB), B. Sc in Computer Science MUK	17 Years
19	Ashaba Nickolas	ODWE (UNEB)	3 Years
20	Wanjori Paul	B. Sc Electrical Engineering (MUK)	3 Years