
LANDMARK UNIVERSITY

COLLEGE OF PURE AND APPLIED SCIENCES

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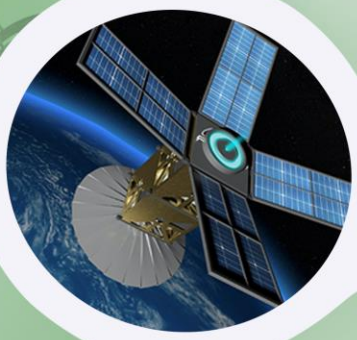

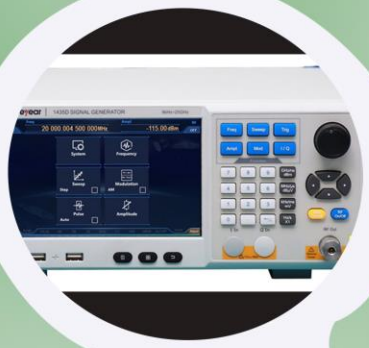


# (B.Sc.) PHYSICS

# Student's HandBook

2023-2028

# LANDMARK UNIVERSITY, OMU-ARAN
## COLLEGE OF PURE AND APPLIED SCIENCES
## DEPARTMENT OF PHYSICAL SCIENCES
## B.Sc. Physics

### University Vision Statement
To be a leading World-class University, by spearheading an agrarian revolution on the African continent through the exploration of hidden treasures in the mother-earth thereby restoring the dignity of the black race.

### University Mission Statements
- Raising a generation of solution providers through a qualitative and life-applicable training system that focuses on value and creative knowledge.

- Raising a new generation of leaders through a broad-based qualitative education built on sound biblical principles culminating in the birth of breadwinners, job creators and world changers.

- Raising an army of reformers who shall redeem the battered image of the black race and restore her lost glory as these well-equipped graduates begin to build the old waste, repair the wasted cities and raise the desolation of many generations as pathfinders.

**Motto:** "Breaking New Grounds"

### Founding Philosophy
- A departure from form to skill
- A departure from knowledge to empowerment
- A departure from figures to future building
- A departure from figures to future building
- A departure from legalism to realism
- A departure from points to facts
- A departure from "mathe-matics" to "life-matics"

### Principal Officers of the University
**Dr. David O. Oyedepo FNAE**
*Chancellor and Chairman Board of Regents*

**Pst. (Mrs.) Faith O. Oyedepo**
*Pro-Chancellor & Vice-Chairperson, Board of Regents*

**Prof. Charity O. Aremu** *B.Sc (Hons), M.Sc., Ph.D. (Ibadan)*
*Vice Chancellor*

**Engr. (Prof.) John O. Ojediran** *B.Eng (Hons), M.Eng., Ph.D. (Ibadan)*
*Deputy Vice Chancellor*

**Adm. Olushola Oyinloye** *B.Sc., M.Sc., FCIA, ACIPM.*
*Ag. Registrar*

**Dr. Ayooluwa Aregbesola** *B.Sc. (Ed), M.Inf. Sc., Ph.D.*
*Ag. Director, Centre for Learning Resources*

**Mr. Christopher Fatiregun** *HND, ACA*
*Director, Financial Services*

**Arc. John M. Alade** *PGD, B.Sc. M.Tech. ARCON, MNIA, FCICPM, FIMC.*
*Director, Physical Planning & Development*

**Dr. Rasaq A. Animashahun** *B.Sc., M.Sc., Ph.D.*
*Dean, Student Affairs*

**Pst. Olutimilehin Omotunbi** *B.Sc.*
*University Chaplain*

**Prof. Ayodele A. Adebiyi** *B.Sc., M.Sc., Ph.D.*
*Dean, College of Pure and Applied Sciences*.

## Staff of the Physics Programme (Tenure)

| SN | Name | Qualification | Area of Specialization | Designation | Status |
|---|---|---|---|---|---|
| 1. | Dr Stephen O. Ikubanni | PhD (Unilorin), MSc (Unilorin), BSc (Hons) (Unilorin) | Atmospheric, Space and Radio Propagation Physics | Senior Lecturer / Ag. HoD, Physical Sciences | Tenured |
| 2. | Prof. B. Olufemi Adebesin | PhD (Unilorin), MSc (OOU), BSc (Hons) (Unilorin) | Atmospheric, Space and Radio Propagation Physics | Professor | Tenured |
| 3. | Dr Shola J. Adebiyi | PhD (Unilorin), MSc (Unilorin), BSc (Ed) (Hons) (Unilorin) | Atmospheric, Space and Radio Propagation Physics | Associate Professor | Tenured |
| 4. | Dr Sesan C. Falade | PhD (OAU), MSc (OAU), BSc (Hons) (OAU) | Geophysics | Lecturer II | Tenured |
| 5. | Mr Kehinde O. Dopamu | MSc (Unilorin), BTech (FUTMINNA) | Geophysics | Lecturer II | Tenured |

| | | | | | |
|---|---|---|---|---|---|
| 6. | Mr Leke S. Adebiyi | MSc (Unilorin), BSc (Unilorin) | Geophysics | Assistant Lecturer | Tenured |
| 7. | Mrs Esther A. Alejolowo | MSc (Ibadan), BSc (Unilorin) | Geology | Assistant Lecturer | Tenured |
| 8. | Mr Sunday O. Ajide | HND, MNISLT | Science Lab. Tech. | Senior Laboratory Technologist III | Tenured |
| 9. | Mr Dada B. Olanrewaju | MSc (Unilorin), BSc (FUTMINNA), MNIP | Physics Electronics and Material Science | Technologist II | Tenured |
| 10. | Mrs Tobi O. Olawepo | ND | Science Lab. Tech. | Principal Laboratory Assistant | Tenured |

# B.Sc. Physics

**Overview**

The B.Sc. Physics degree program is design to provide basic foundation of Physics in the first and second year through courses covering classical physics, electricity and magnetism, waves and optics, dynamics, thermodynamics, modern physics, computer literacy, and special theory of relativity, as well as underlining mathematical concepts that underpin a better understanding of the courses. The scope of energy and environment as well as weather and space science had been widened in line with the global concern on sustainable development. A new course on workshop practice had been introduced to provide the students with a flavour of engineering design and electronic instrumentation.

The third-year courses of the program build on the basic foundations and cover the transition between classical and quantum physics including electromagnetic waves, electromagnetism, statistical physics, and the student industrial work experience scheme design to compliment the theory learned in the classroom and practical applications and experience of the industries. The diverse topics covered as taught courses will be complimented during each year by laboratory practical's that enable the students understand and appreciate the principles, theorems, and laws in physics.

The fourth-year courses of the program are designed to provide further mathematical knowledge that buttress the applications of quantum mechanics, nuclear physics, and of special mathematical functions in physics. A range of diverse modern courses have been introduced to enable the students choose from various fields of specialization in physics as well as to carry out a scientific research project.

**Philosophy**

The philosophy of the programme is to provide supportive learning environment for the training of students in both theoretical knowledge and experimental skills in

physics, ready and capable for further academic pursuit, research, or work in all relevant fields for human development.

**Objectives**

The objectives of the programme are to;

1. provide students with a broad and balanced foundation of physics knowledge and practical skills;
2. instil in students a sense of enthusiasm for physics, and appreciation of its applications in different contexts;
3. instil in students a culture of creativity and critical thinking that will enable them to seek solutions to problems;
4. involve the students in intellectually stimulating and satisfying experience in knowledge pursuit;
5. develop in students the ability to apply their knowledge and skills in Physics to the solution of theoretical and practical problems;
6. develop in students through an education in Physics a range of transferable skills of value in physics and other areas; and
7. provide students with a knowledge and skills base for further studies in Physics or multidisciplinary areas involving physics.

**Unique Features of the Programme**

The blend of courses in this revised curriculum are meant to provide:

1. topics that cover modern areas of research and developments in physics in tune with best practices of globally top rated universities;
2. course structures that are also designed in such a way to prepare the students towards multidisciplinary advanced studies.;
3. a course on workshop practices which is intended to expose the students to instrumentation and engineering design that will enable them produce simple instruments for either training and or research; and
4. a course on entrepreneurship for physicist which is also intended to provide the students with the required skills for innovation and job creation.

**Employability Skills**

The range of courses to be covered in the program are intended to prepare and equip the student's with the necessary and relevant theoretical knowledge and practical skills that are required of a physicist in:

1. Foresight
2. Resourcefulness
3. Planning
4. Organization
5. Time management
6. Design and execution of local and global challenges with solutions that are multidimensional and with professionalism.

**21st Century Skills**

1. Creativity
2. Communication and IT
3. Design and Construction
4. Planning and Experimentation
5. Innovation and Entrepreneurship

**Admission and Graduation Requirements**

**Admission Requirements**

Candidates can be admitted into the programme through either the indirect-entry mode or direct entry (DE).

**Indirect-entry mode**

The entry requirements shall be at least credit level passes in five subjects including English language, mathematics, physics and chemistry to form the core subjects with credit in one other relevant science subject at the senior secondary certificate (SSC) or its equivalent. In addition, an acceptable pass in the unified tertiary matriculation examination (UTME) is required for admission into 100-level. This category of candidates would spend a minimum of four (4) academic sessions or eight (8) semesters.

**Direct entry (DE)**

Candidates with two passes (graded A-E) at the advanced level in physics and one of two relevant subjects (chemistry, and mathematics) may be admitted into 200-level. This category of candidates would spend a minimum of three (3) academic sessions or six (6) semesters.

**Graduation Requirements**

Candidates admitted into the 100 level of the 4-year B.Sc. Physics programme of required to pass a minimum of 120 prescribed credits (comprising of the faculty courses MTH 101, 102, and COS 101 and all core courses) to be eligible for graduation. Direct entry candidates admitted into 200 level of the 4-year program are required to pass a minimum of 90 prescribed credits to be eligible for graduation.

**Global Course Structure**

Four (4) Year B.Sc. Physics programme

**100 Level**

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| GST 111 | Communication in English | 2 | C | 15 | 45 |
| GST 112 | Nigerian People and Culture | 2 | C | 30 | - |

| | | | | | |
|---|---|---|---|---|---|
| COS 101 | Introduction to Computing Sciences | 3 | C | 30 | 45 |
| MTH 101 | Elementary Mathematics I | 2 | C | 30 | - |
| MTH 102 | Elementary Mathematics II | 2 | C | 30 | - |
| PHY 101 | General Physics I | 2 | C | 30 | - |
| PHY 102 | General Physics II | 2 | C | 30 | - |
| PHY 103 | General Physics III | 2 | C | 30 | - |
| PHY 104 | General Physics IV | 2 | C | 30 | - |
| PHY 107 | General Practical Physics I | 1 | C | - | 45 |
| PHY 108 | General Practical Physics II | 1 | C | - | 45 |
| | **Total** | **21** | | | |

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| LMU-PHY 101 | General Chemistry I | 2 | C | 30 | - |
| LMU-PHY 103 | General Chemistry Practical II | 1 | C | - | 45 |
| LMU-TMC 111 | Total Man Concept I | 1 | C | 15 | - |
| LMU-TMC 121 | Total Man Concept II | 1 | C | 15 | - |
| LMU-CST 111 | Use of Library, Study Skills and Information Communication Technology | 2 | C | 15 | 45 |
| LMU-CFR 121 | Communication in French | 1 | C | 15 | - |
| | **TOTAL** | **8** | | | |

**200 Level**

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| GST 212 | Philosophy, Logic and Human Existence | 2 | C | 30 | - |
| ENT 211 | Entrepreneurship and Innovation | 2 | C | 15 | 45 |
| PHY 201 | General Physics V (Modern Physics) | 2 | C | 30 | - |
| PHY 202 | Introduction to Electric Circuits & Electronics | 2 | C | 30 | - |
| PHY 204 | General Physics VI (Waves and Optics) | 2 | C | 30 | - |
| PHY 205 | Thermal Physics | 2 | C | 30 | - |
| PHY 206 | General Physics VII (Energy & Environment) | 2 | C | 30 | - |
| PHY 207 | General Practical Physics III | 1 | C | - | 45 |
| PHY 208 | General Practical Physics IV | 1 | C | - | 45 |
| PHY 211 | Workshop Practice | 2 | C | 15 | 45 |
| | **Total** | **18** | | | |

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| LMU-PHY 201 | Principles of Remote Sensing | 2 | C | 30 | - |
| LMU-PHY 202 | Physics of Solar Radiation and the Earth's Atmosphere | 2 | C | 30 | - |
| LMU-PHY 203 | Basic Physics of the Solid Earth | 2 | C | 30 | - |
| LMU-PHY 204 | Introduction to Numerical Analysis | 2 | C | 30 | - |
| LMU-PHY 205 | MATLAB for Physicist | 1 | C | 15 | - |
| LMU-TMC 211 | Total Man Concept III | 1 | C | 15 | - |
| LMU-TMC 221 | Total Man Concept IV | 1 | C | 15 | - |
| | **TOTAL** | **11** | | | |

**300 Level**

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| GST 312 | Peace and Conflict Resolutions | 2 | C | 30 | - |
| ENT 312 | Venture Creation | 2 | C | 15 | 45 |
| PHY 301 | Analytical Mechanics I | 2 | C | 30 | - |
| PHY 303 | Electromagnetism | 3 | C | 45 | - |
| PHY 304 | Electromagnetic Waves and Optics | 3 | C | 45 | - |
| PHY 305 | Quantum Physics | 3 | C | 45 | - |
| PHY 306 | Statistical and Thermal Physics | 2 | C | 30 | - |
| PHY 307 | General Physics Practical V | 1 | C | - | 45 |
| PHY 308 | General Physics Practical VI | 1 | C | - | 45 |
| PHY 318 | Semiconductor Devices | 3 | C | 45 | - |
| PHY 399 | Industrial Attachment II (12 Weeks) | 3 | C | | |
| | **Total** | **25** | | | |

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| LMU-PHY 301 | Energy Sources, Conversion, and Storage | 2 | C | 30 | - |
| LMU-PHY 302 | Physics of the Ionosphere | 2 | E | 30 | - |
| LMU-PHY 303 | Communication Systems | 2 | E | 30 | - |
| LMU-PHY 304 | Digital Electronics | 2 | E | 30 | - |
| LMU-PHY 306 | Principles of Electronics | 2 | E | 30 | - |
| LMU-PHY 305 | Gravity and Magnetic Prospecting Methods | 2 | E | 30 | - |
| LMU-PHY 308 | Electrical and Electromagnetic Methods of Geophysics | 2 | E | 30 | - |
| LMU-PHY 310 | Seismicity of the Earth and Seismic Exploration Methods | 2 | E | 30 | - |

| | | | | | |
|---|---|---|---|---|---|
| LMU-TMC 311 | Total Man Concept V | 1 | C | 15 | - |
| LMU-TMC 321 | Total Man Concept VI | 1 | C | 15 | - |
| | **TOTAL** | **18** | | | |

**(4 compulsory and minimum 6 elective units)**

**400 Level**

| Course Code | Course Title | Units | Status | LH | PH |
|---|---|---|---|---|---|
| PHY 401 | Quantum Mechanics I | 3 | C | 45 | - |
| PHY 402 | Quantum Physics II | 3 | C | 45 | - |
| PHY 403 | Mathematical Methods in Physics I | 3 | C | 45 | - |
| PHY 404 | Mathematical Methods in Physics II | 3 | C | 45 | - |
| PHY 405 | Physics Entrepreneurship | 2 | C | 30 | - |
| PHY 455 | Research Project | 6 | C | - | 270 |
| | **Total** | **20** | | | |

| Course Code | Course Title | Unit(s) | Status | LH | PH |
|---|---|---|---|---|---|
| LMU-PHY 401 | Satellite Communication | 2 | C | 30 | - |
| LMU-PHY 402 | Wireless and Mobile Communications | 2 | E | 30 | - |
| LMU-PHY 403 | Introduction to Space Science | 2 | E | 30 | - |
| LMU-PHY 404 | Design and Installation of Electrical & ICT Equipment | 2 | E | 30 | - |
| LMU-PHY 407 | Advanced Electronics Laboratory | 1 | E | - | 45 |
| LMU-PHY 405 | Geophysical data analysis and interpretation with software applications | 2 | E | 15 | 45 |
| LMU-PHY 406 | Applications of Geophysics | 2 | E | 30 | - |
| LMU-TMC 411 | Total Man Concept VII | 1 | C | 15 | - |
| LMU-TMC 421 | Total Man Concept VIII | 1 | C | 15 | - |
| | **TOTAL** | **15** | | | |

**(4 compulsory and minimum 4 elective units)**

**Total Compulsory units developed for the 30% CCMAS = 27 units**
**Total Elective units developed for the 30% CCMAS = 25 units**

## Course Contents and Learning Outcomes

## 100 Level

### GST 111: Communication in English (2 Units C: LH 15; PH 45)

**Learning Outcomes**

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

1. identify possible sound patterns in English Language;
2. list notable Language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

**Course Contents**

Sound patterns in English Language (vowels and consonants, phonetics, and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple, and complex). Grammar and Usage (tense, mood, modality and concord, aspects of language use in everyday life). Logical and critical thinking and reasoning methods (logic and syllogism, inductive and deductive argument and reasoning methods, analogy, generalisation and explanations). Ethical considerations, copyright rules, and infringements. Writing activities: (pre-writing, writing, post writing, editing and proofreading; brainstorming, outlining, paragraphing). Types of writing: summary, essays, letter, curriculum vitae, report writing, note making etc. Mechanics of writing. Comprehension Strategies: (reading and types of reading, comprehension skills, 3RsQ). Information and Communication Technology in modern Language Learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening. Report writing.

### GST 112: Nigerian peoples and culture (2 Units C: LH 30)

**Learning Outcomes**

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

1. analyse the historical foundation of the Nigerian culture and arts in pre-colonial times;
2. list and identify the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political unit;
4. analyse the concepts of Trade, Economic and Self-reliance status of the Nigerian peoples towards national development;

5. enumerate the challenges of the Nigerian State towards Nation building;
6. analyse the role of the Judiciary in upholding people's fundamental rights;
7. identify acceptable norms and values of the major ethnic groups in Nigeria; and
8. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problems.

**Course Contents**

Nigerian history, culture and art up to 1800 (yoruba, hausa and igbo peoples and culture, peoples and culture of the ethnic minority groups). Nigeria under colonial rule: (advent of colonial rule in Nigeria, Colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914, formation of political parties in Nigeria, Nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian civil war). Concept of trade and economics of self-reliance (indigenous trade and market system, indigenous apprenticeship system among Nigeria people, trade, skill acquisition and selfreliance). Social justices and national development (law definition and classification). Judiciary and fundamental human rights. Individual, norms, and values (basic Nigeria norms and values, patterns of citizenship acquisition, citizenship and civic responsibilities, indigenous languages, usage, and development, negative attitudes and conducts. Cultism, kidnapping and other related social vices). Re-orientation, moral and national values (The 3R's – reconstruction, rehabilitation and re-orientation strategies, operation feed the nation (OFN), green revolution, austerity measures, war against indiscipline (WAI), war against indiscipline and corruption (WAIC), mass mobilization for self-reliance; social justice and economic recovery (MAMSER), national orientation agency (NOA), current socio-political and cultural developments in Nigeria).

**MTH 101: Elementary Mathematics I (Algebra and Trigonometry)**

**(2 Units C: LH 30)**

**Learning Outcomes**

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

1. explain the basic definition of set, subset, union, intersection, complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify and use various types of numbers; and
5. solve some problems using binomial theorem.

**Course Contents**

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers; integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers; algebra of complex numbers; the Argand diagram. De-Moivre's theorem,

nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

**MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. identify the types of rules of differentiation and integration;
2. describe the meaning of function of a real variable, graphs, limits and continuity and their applications; and
3. solve some applications of definite integrals in areas and volumes.

**Course Contents**

Function of a real variable (graphs, limits, and idea of continuity). The derivative as limit of rate of change. Techniques of differentiation. Extreme curve sketching. Integration as an inverse of differentiation. Methods of integration. Definite integrals (application to areas and volumes).

**COS 101: Introduction to Computing Sciences (3 Units C: LH 30; PH 45)**

**Learning Outcomes**

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

1. explain basic components of computers and other computing devices;
2. describe the various applications of computers;
3. explain information processing and its roles in the society;
4. describe the Internet, its various applications and its impact;
5. explain the different areas of the computing discipline and its specializations; and
6. demonstrate practical skills on using computers and the internet.

**Course Contents**

Brief history of computing. Description of the basic components of a computer/computing device. Input/Output devices and peripherals. Hardware, software and human ware. Diverse and growing computer/digital applications. Information processing and its roles in society. The Internet, its applications and its impact on the world today. The different areas/programs of the computing discipline. The job specializations for computing professionals. The future of computing.

**Lab Work:** Practical demonstration of the basic parts of a computer. Illustration of different operating systems of different computing devices including desktops, laptops, tablets, smart boards and smart phones. Demonstration of commonly used applications such as word processors, spreadsheets, presentation software and graphics. Illustration of input and output devices including printers, scanners,

projectors and smartboards. Practical demonstration of the Internet and its various applications. Illustration of browsers and search engines. How to access online resources.

**PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)**

**Learning Outcome**

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

1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

**Course Contents**

Space and time. Units and dimension. Vectors and scalars. Differentiation of vectors (displacement, velocity and acceleration). Kinematics. Newton's laws of motion (Inertial frames, impulse, force and action at a distance, momentum conservation). Relative motion. Application of Newtonian mechanics. Equations of motion. Conservation principles in physics (conservative forces, conservation of linear momentum, kinetic energy and work, potential energy). System of particles. Centre of mass. Rotational motion (torque, vector product, moment, rotation of coordinate axes and angular momentum). Coordinate systems. Polar coordinates. Conservation of angular momentum. Circular motion. Moments of inertia (gyroscopes, and precession). Gravitation (Newton's Law of Gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits).

**PHY 102: General Physics II (Electricity & Magnetism) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. describe and determine the magnetic field for steady and moving charges;
4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;

5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws;
6. explain the basic physical significance of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters; and
8. determine the characteristics of AC voltages and currents in resistors, capacitors, and Inductors.

**Course Contents**

Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance). Ohm's law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

## PHY 103: General Physics III (Behaviour of Matter) (2 Units C: LH 30)

**Learning Outcomes**

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

1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive, and apply the fundamental thermodynamic relations to thermal systems;
3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

**Course Contents**

Heat and temperature (temperature scales). Gas laws. General gas equation. Thermal conductivity. First Law of thermodynamics (heat, work and internal energy, reversibility). Thermodynamic processes (adiabatic, isothermal, isobaric). Second law of thermodynamics (heat engines and entropy). Zeroth law of thermodynamics. Kinetic theory of gases. Molecular collisions and mean free path. Elasticity (Hooke's law, Young's, shear and bulk moduli). Hydrostatics (Pressure, buoyancy, Archimedes' principles). Bernoulli's equation and incompressible fluid flow. Surface tension (adhesion, cohesion, viscosity, capillarity, drops and bubbles).

**PHY 104: General Physics IV (Vibration Waves and Optics) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. describe and quantitatively analyse the behaviour of vibrating systems and wave energy;
2. explain the propagation and properties of waves in sound and light;
3. identify and apply the wave equations; and
4. explain geometrical optics and principles of optical instruments.

**Course Contents**

Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Resonance and transients. Coupled SHM. Q values and power response curves. Normal modes. Waves (types and properties of waves as applied to sound). Transverse and longitudinal waves (superposition, interference, diffraction, dispersion, polarization). Waves at interfaces (energy and power of waves). The wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo and beats. The Doppler-effect. Propagation of sound in gases, solids and liquids and their properties.

Optics: Nature and propagation of light. Reflection and refraction. Internal reflection. Scattering of light. Reflection and refraction at plane and spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Dispersion. Huygens's principle (interference and diffraction).

**PHY 107: General Practical Physics I (1 Unit C: PH 45)**

**Learning Outcomes**

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

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

**Course Contents**

This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

**PHY 108: General Practical Physics II (1Unit C: PH 45)**

**Learning Outcomes**

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

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

**Course Contents**

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

**LMU-CHM 101: General Chemistry I (2 Units C: LH 30)**

**Senate Approved Relevance**

General chemistry is crucial for Landmark University's vision and mission as it provides students with a strong foundation in the scientific method, critical thinking, and problem-solving skills, which are essential for sustainable development and contributing to the agrarian revolution. Furthermore, it enables students to understand the principles and concepts of chemistry, which are necessary for exploring hidden treasures in the mother-earth and developing innovative solutions for environmental management, pollution control, and renewable energy sources. Finally, general chemistry aligns with Landmark University's commitment to providing value-based education, emphasizing ethical considerations, social responsibility, and sustainable development.

**Overview**

This course aims to provide a strong foundation in the principles of chemistry for Physics students. It focuses on the fundamental concepts of chemistry; whose knowledge is required to understand some higher level Physics courses.

The course starts with an introduction to atoms, molecules, elements and compounds, and chemical reactions. It then considers the modern electronic theory of atoms, electronic configuration, periodicity and building up of the periodic table. Students will learn about the hybridization and shapes of simple molecules and the valence forces that hold atoms together in molecules. The students will also learn about the structure of solids and chemical equations and stoichiometry. They will also gain an understanding of chemical bonding and intermolecular forces, as well as the kinetic

theory of matter. The course will cover elementary thermochemistry, including heat transfer and energy changes during chemical reactions.

The course will also provide knowledge on the rates of reaction, equilibrium and thermodynamics. Students will learn about acids, bases, and salts and how they behave in solutions. The properties of gases will also be studied in depth. The course will culminate in a discussion of redox reactions and an introduction to electrochemistry. Students will gain an understanding of radioactivity and its applications in everyday life.

**Objectives**

The objectives of the course are to:

1. outline the basic concepts of chemistry, including atoms, molecules, elements, and compounds;
2. describe chemical reactions and their role in the formation of compounds and molecules;
3. outline the modern electronic theory of atoms and its importance in understanding the behaviour of matter;
4. explain the fundamental structure of atoms, including the number of protons, neutrons, and electrons in an atom;
5. explain electron configurations and the periodic table;
6. describe hybridization and how it influences the shape of simple molecules;
7. explain the valence forces that hold atoms together in molecules, including ionic, covalent, and metallic bonds;
8. describe the structure of solids, including the different types of crystalline and amorphous solids;
9. state the properties of solids, including their mechanical, thermal, and electrical properties;
10. explain stoichiometry;
11. describe chemical bonding and intermolecular forces and their relationship to the properties of materials;
12. state kinetic theory of matter and describe how it is used to explain the behaviour of gases, liquids, and solids;
13. explain the basic principles of thermochemistry, including energy transfer and the laws of thermodynamics.
14. list the factors that influence the rate of a chemical reaction, including temperature, concentration, and catalysts.
15. describe the behaviour of acids, bases, and salts, including their properties and reactions;
16. explain pH and its relationship to the strength of acids and bases;
17. state the properties of gases and their behaviour under different conditions;
18. recall an overview of oxidation-reduction reactions and their applications in industrial processes;
19. outline the basic principles and applications of radioactivity and nuclear chemistry.

**Learning Outcomes**

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

1. define atom, molecules and chemical reactions;

2. discuss the Modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. justify the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;
5. identify and balance oxidation – reduction equation and solve redox titration problems;
6. illustrate shapes of simple molecules and hybridized orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using LeChatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

**Course Contents**
Atoms, molecules, elements and compounds and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridization and shapes of simple molecules. Valence Forces. Structure of solids. Chemical equations and stoichiometry. Chemical bonding and intermolecular forces. Kinetic theory of matter. Elementary thermochemistry. Rates of reaction. Equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

**Minimum Academic Standards**
None.

**LMU-CHM 107: General Chemistry Practical I (1 Unit C: LH 45)**

**Senate Approved Relevance**
General Chemistry Practical is a foundational laboratory course that complements the theoretical concepts taught in General Chemistry. It provides physics students with practical skills in chemical analysis and laboratory techniques, which are essential for future studies and careers in science and engineering. By developing students' practical skills, the course helps to prepare them to become innovative and effective leaders who can use their knowledge to solve real-world problems. Moreover, the course helps to enhance students' learning outcomes by providing them with opportunities to apply theoretical knowledge to practical problems, and to develop critical thinking and problem-solving skills. This aligns with the Landmark University's vision to raise a new generation of leaders who will transform their communities and the world.

**Overview**
This is a laboratory course that complements the "General Chemistry for Physics Students" course by providing hands-on experience with the basic concepts and techniques of chemistry. The course is designed to help students develop practical skills in chemical experimentation and data analysis, while also reinforcing the theoretical concepts covered in the lecture-based course.

Throughout the course, students will perform a series of experiments that explore topics such as stoichiometry, acid-base titrations, electrochemistry, and spectroscopy. They will learn how to handle and manipulate chemicals, measure quantities and properties of substances, record and analyze experimental data, and draw conclusions based on their results.

The course is typically taken in conjunction with the lecture-based "General Chemistry for Physics Students" course, although it may also be taken separately by students who have a solid foundation in basic chemistry. Overall, the course is designed to provide students with a well-rounded education in chemistry that will help them succeed in a wide range of scientific fields.

**Objectives**
The objectives of this course are to:
1. ensure students understand the general rules and safety procedures;
2. expose students to potential hazards and risks, and promote safe handling of chemicals;
3. develop skills for the design/plan of chemical experiments and data collection;
4. select the appropriate glassware and equipment and illustrate their proper handling;
5. develop practical skills in using standard solutions;
6. develop practical skills in solution preparation, result calculation, and data interpretation in redox titrations;
7. develop skills for maintaining a clear, organized, and properly formatted laboratory notebook;
8. communicate observations/findings through written reports and presentations.

**Learning Outcomes**
At the end of this course, the students should be able to:
1. describe the general laboratory rules and safety procedures;
2. collect scientific data and correctly carrying out Chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. differentiate between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

**Course Contents**
Laboratory experiments designed to reflect topics presented in courses LMU-CHM 101 These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

**Minimum Academic Standards**
A laboratory with basic chemical glassware, equipment, and chemicals.

**LMU-TMC 111: Total Man Concept I (1 Unit C: LH 15)**

**Senate Approved Relevance**
The training of the God-fearing and morally minded excellent graduates for academic skills and character development for future leadership and decision-making forms part of the quests for Landmark University's vision and mission. Consequently, this course LMU-TMC111 module is designed to help students explore their purpose and pursuit in life by introducing them to the biblical, philosophical and experiential teachings. The course is expected to promote self-discovery and self-actualization of the endowed potentials among the students for making the most of life. To this end, it will just be proper for senate approval.

**Overview**
The course introduces the students to Total Man Concept (TMC) by providing teachings with focus on the understanding of life and development of a total man. The course explains the triune nature of man, espousing the fundamental aspects of the Total Man Concept i.e the Spirit, soul and body and seeks to guide the students into a search for their individual purposes for living.

LMU-TMC111 It also equips the students with the knowledge required to explore life from the biblical, philosophical and experiential perspectives. LMU-TMC111 emphasizes the seven core values of the University, thereby empowering the students to make the best use of their time on campus. The foundational anchors of life, the place of visions, dreams, goals, and the foundational principles for making the most of life.

**Objectives**
The objectives of this course are to:
1. define Total Man Concept;
2. state the important anchors in life;
3. list the seven Landmark core values which are essential for successful living;
4. apply the listed seven core values to their daily life practices;
5. differentiate between vision and ambition;
6. identify the place of dreams and goals;
7. distinguish between purpose and pursuit in life.

**Learning Outcomes**:
At the end of this course, students should be able to:
1. define Total Man Concept;
2. list at least four (4) important anchors in life;
3. list the seven (7) Landmark core values which are essential for successful living;
4. differentiate between vision and ambition;

5. identify the place of dreams and goals in life;
6. distinguish between purpose and pursuit in life.

**Course Contents**
Introduction to TMC: Understanding the Concept of the Total Man (Body, Soul Spirit/ the Triune Man). The place of Man in God's Agenda. Life Purposes & Pursuits. Anchors of Life. Exploring God's Redemption Package. Health talk. The Place of Prayer in the Fulfilment of Destiny. Biblical Prescriptions for triumphant life (Situating the LMU Core Value - Integrity). Biblical Prescriptions for triumphant life (Situating the LMU Core Value - Capacity Building). Biblical Prescriptions for triumphant life (Situating LMU Core Values - Possibility Mentality). Understanding Divine Inspiration. Biblical Prescriptions for triumphant life (Situating the LMU Core Value - Responsibility & Sacrifice). Vision, Dreams & Guidance. Biographical Studies of men who succeeded via the spirituality core value.

**Minimum Academic Standards**
None.

**LMU-TMC 121: Total Man Concept II (1 Unit C: LH 15)**

**Senate Approved Relevance**
This course is in tandem with the vision and mission of the Landmark University with focus on self-discovery and building ones' spiritual and mental potentials as future leaders and solution providers. These solution providers will proffer solutions to the problems and challenges facing Nigeria as a country and the world at large. LMU-TMC121 focuses on self-discovery with the hope of enhancing personal values that culminates into life success and fulfilment through the sound spiritual mind-set and abstinence from all vices and indiscipline. It is capable of inculcating biblical principles to students, unleashing the benefits and realities of redemption which can rescue youths from vices such as drug abuse These are some of the reasons for inclusion of LMU-TMC121. To this end, it will just be proper for senate approval.

**Overview**
This course begins with the general overview of self-discovery. The reason why several students are caught in the web of bad company and evil vices is the absence of self-discovery. Therefore, knowing that experience is not the best teacher, LMU-TMC121 presents different biblical models of self-discovery, which the students can emulate as they continue in this developmental stage of their lives.

LMU-TMC121 unveils the links between the self-discovery and the spiritual capacity building. It explains the pathways to self-discovery, as well as the redemption realities in Christ, the nature and power of the mind amongst others. LMU-TMC121 maintains that the Christian life is characterized by good conscience. It teaches abstinence from hard drugs, sexual immoralities and other evil vices. This course is in place to make the students discover themselves to preserve their personal values that guarantees the fulfilment of purposes in life.

**Objectives**
The objectives of the course are to:
1. list the pathways to self-discovery;
2. develop positive image of their person;
3. describe mind dynamics;
4. mention four examples of biblical models of self-discovery;
5. identify the link between self-discovery and mind dynamics;
6. list the dangers of drug abuse;
7. distinguish what characterises good conscience.

**Learning Outcomes**
At the end of this course, students should be able to:
1. define their life goals;
2. develop positive image of their person;
3. describe mind dynamics;
4. state four (4) examples of biblical models of self-discovery;
5. identify the link between self-discovery and mind dynamics;
6. state four (4) dangers of drug abuse;
7. describe a good conscience.

**Course Contents**
Overview of Self-Discovery. Biblical Models of Self-Discovery. Self-Discovery and Spiritual Capacity Building. Pathways to Self-Discovery. Self-Discovery and Redemption realities. Mind Dynamics and Self-Discovery. Nature and Power of the Mind. Self-Discovery and Body Dynamics. Health Talk (Danger of hard drugs, Self-Medication, Drug Abuse, STD). The Power of Conscience. Self-Discovery and Personal Values. Fulfilling your Purpose

**Minimum Academic Standards**
None.

**LMU-CST 111: Use of Library, Study Skills and Information Communication Technology (2 Units C: LH 15; PH 45)**

**Senate Approved Relevance**
As information hubs of any higher educational institutions, libraries are established to support the tripartite objectives of teaching, learning and research which are fundamental to academia. This commits the Senate of the University to place strong emphasis on the teaching and learning of the various ways to maximise the use of library resources and services. This course set to provide students in the entry year/semester an understanding of the use of library, study skills and information communication technology that contribute significantly to facilitating teaching, learning and research across all disciplines particularly in alignment with the foundational ethos of the Landmark University vision.

**Overview**
The library is the power-house, the engine or the heart upon which teaching, learning, and research thrive. No meaningful research takes place without consulting with several information resources which resides in the library. Hence, upwardly mobile institutions around the world focus on the use of libraries for quality research, institutional visibility and academic reputation. The Use of Library, Study Skills and Information Communication Technology course provides solid background for fresh students whose knowledge of the basic concepts taught will be needed in understanding and using library resources and information communication technologies.

Thus, maximising the use of library for teaching, learning and research, which are fundamental to academia and to Landmark University in particular. This University Wide Course, CST 111 - Use of Library, Study Skills and Information Communication Technology is geared towards equipping the students with requisite knowledge to enable them to maximise the use of the deluge of resources at the Library. It is also designed to enable students demonstrate dexterity in the use of information and communication technology ranging from hardware and software applications so as to function effectively in research and learning.

The course cuts across all departments/programmes. However, it will be anchored, taught and examined at the Centre for Learning Resources, lecturers from the Department of Computer Science will participate in the teaching of the course.

**Objectives**
The objectives of this course are to:
1. describe the history, development and functions of libraries;
2. explain intellectual property rights;
3. list the importance of citation;
4. describe the learning environment – the library perspective;
5. identify and describe appropriate skills for note-making;
6. describe and demonstrate the use of library online databases;
7. identify various information retrieval mechanisms;
8. describe the concept, value, dynamism, sources and formats of information as imperative for scholarship and learning;
9. describe types of computers according to their generations, sizes and application domain;
10. describe and demonstrate MSWord office basic features, formatting paragraph and working with styles;
11. describe and demonstrate a range of advanced tools and techniques in MS Excel.

**Learning Outcomes**
On completion of the course, students should be able to:
1. describe the history and development of libraries;
2. state at least three (3) intellectual property law principles and apply them to real problems;
3. analyse the social impact of intellectual property law and policy;
4. define learning and explain at least five importance of learning;

5. define listening and describe the listening process;
6. describe at least two (2) strategies for effective listening and note-making;
7. demonstrate mastery of at least two (2) of the library online databases;
8. identify at least two (2) various information retrieval mechanisms;
9. state the differences among data, information and knowledge;
10. describe the concept, value, dynamism, sources and formats of information as imperative for scholarship and learning;
11. classify computers into different types according to their generations, sizes and application domain;
12. demonstrate the ability to use at least fifteen (15) MS Word office basic features;
13. demonstrate the ability to use a range of advanced tools and techniques in MS Excel.

**Course Contents**

History, development and functions of libraries. Learning environment – the library perspective. Concept of information. Information literacy. Information sources and access. Copyright issues. Citation and citation formats. Improving listening and note making skills. Internet and library online databases. Identification of PC parts and peripheral devices: functions, applications and how to use them. Types of Computers. Word processing: principle of operation and application. Demonstration and practical hand-on exercises in word processing using a popular word processing package. MS Word office basic features. Formatting paragraph and working with styles. Internet: services available, principle of operation, application, demonstration and hand-on practical exercises on e-mail and www using popular browsers. Spreadsheet: principle of operation and application. Demonstration and practical hands-on exercises in spreadsheet using a popular spreadsheet package.

**LMU-CFR 121: Communication in French (1 Unit C: LH 15)**

**Senate Approved Relevance**

Since the vision of the University is raising a generation of leaders, whose impacts will positively and immensely be felt globally, this course presents a rare opportunity for students who desire to make impact in French speaking nations, and those who may find themselves in any French speaking environment or situation. Today, globalization in every sector is gaining high waves by the day, more experts in foreign languages like French, German, Spanish etc. are daily being clamoured for, for tasks in countries where English is not the official language. For this reason, this course tends to offer the basic knowledge and the opportunities to students to enhance their cumulative linguistic growth in the areas of French phonetics, morphology and syntax. The course focuses on the correct pronunciation of French words, correct formation of French words and their arrangements in simple French sentences. Students who take this course are to seize the opportunity to make French an addition to their intellectual wealth, which can yield a great measure of reward and privileges in their international endeavours. To this end, it will just be proper for senate approval.

**Overview**

Communication in French is an integral part of the University Wide Courses programme of Landmark University, which aims at, apart from meeting the requirements for a successful university education, grooming students who will be able to express themselves in French, and build their competence in all the four language skills: listening, speaking, reading and writing. The course focuses on teaching the students to express themselves in basic French. With this, it will serve as an added advantage of other foreign language for students in their various fields of specialisation. This course allows the students to have the basic knowledge of French grammar and parts of speech. It introduces the students to different forms of greetings in each time of the day. Also, students will learn vocabularies on family and friends, verb conjugations (auxiliary verbs of *être* and *avoir*), verbs in –er, -ir, -ir), reflexives verbs, and how to use them to form simple sentences.

In addition, students will learn different types of adjectives and pronouns, negatives, cardinal and ordinal numbers, professions and nationalities, how to say the time and date and how to tell one's age in French. Other relevant topics include the use of negatives, how to say the parts of the body in French. Students will also be introduced to French and Francophone civilisations to expose them to the knowledge of Nigeria in relation to ECOWAS, France and West African Francophone countries.

**Objectives**

The objectives of this course are to:

1. construct simple sentences in French on their own to express simple greetings;
2. conjugate French verbs correctly into present tense to form simple sentences;
3. mention French pronouns and adjectives and use them to form simple and correct sentences;
4. mention correctly the days of the week and the months of the year;
5. count French cardinal and ordinal numbers correctly from one to millions;
6. change the affirmative sentences in French by using correctly different types of negative;
7. list the Francophone countries in West Africa with their state capitals;
8. state the full meaning of CEDEAO (ECOWAS) and all what it is all about;
9. list the differences and similarities among Nigeria with France and Francophone countries in West Africa.

**Learning Outcomes**

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

1. construct at least five (5) simple sentences in French on their own to express their greetings to friends and loved ones;
2. conjugate at least two (2) French verbs correctly into present tense to form simple sentences on their own;
3. list at least seven (7) French pronouns and adjectives and use them to form simple and correct sentences on their own;
4. list correctly the days of the week and the months of the year;
5. count French cardinal and ordinal numbers correctly from one to millions;
6. change the affirmative sentences in French by using correctly different types of negative;

7. list at least three (3) the Francophone countries in West Africa with their state capitals;
8. state the full meaning of CEDEAO (ECOWAS) and all what it is all about;
9. list at least three (3) differences and similarities each, among Nigeria with France and Francophone countries in West Africa.

**Course Contents**
Introduction. Les salutations en français. Vocabulaire de famille et d'amis. Les articles et les pronoms personnels. Les verbes: *être, avoir, s'appeler, travailler, voyager, parler, manger,* etc. au présent, *Le*, *la*, *l'*and *les* comme pronoms objets. Les professions et les nationalités. Se presenter. Les nombres: cardinaux et ordinaux, Vocabulaire d'argent et de quantité. Quelle heure est-il? Quel âge as-tu? Les jours de la semaine/ les mois de l'année. Vocabulaire de couleurs. Les prepositions. Emploi de « où se trouve/trouvent? », Les adjectifs. Les adverbs. Le Nigéria et la France. La CEDEAO. Vocabulaire de banque et d'ordinateur. La negation. Vocabulaire de manger et de cuisine. Exprimer ses goûts. Les parties du corps. Vocabulaire de santé. Vocabulaire d'école et d'études. Vocabulaire d'animaux. Vocabulaire de nourriture et d'aliments. Expressions et vocabulaires utiles. Passages de compréhension révisée. Révision générale/examen.

**Minimum Academic Standards**
None.

## 200 Level

**GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)**

**Learning Outcomes**
A student who has successfully gone through this course should be able to:
1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically asses the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

**Course Contents**

Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding, etc.

**ENT 211: Entrepreneurship and Innovation (2 Units C: LH 15; PH 45)**

**Learning Outcomes**

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

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation, and risk taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence; and
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe stages in enterprise formation, partnership and networking including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa, and the rest of the world.
8. state the basic principles of e-commerce.

**Course Contents**

Concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship,).

Theories, rationale, and relevance of entrepreneurship (Schumpeterian and other perspectives. Risk-taking, necessity and opportunity-based entrepreneurship and Creative deduction. Characteristics of entrepreneurs (opportunity seeker, risk taker, natural and nurtured, problem solver and change agent, innovator, and creative thinker). Entrepreneurial thinking (critical thinking, reflective thinking, and creative thinking). Innovation (concept of innovation, dimensions of innovation, change and innovation, knowledge, and innovation). Enterprise formation. Partnership and networking (basics of business plan, forms of business ownership, business registration and forming alliances and join ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office, networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship. Entrepreneurship support institutions. Youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

**PHY 201: General physics V (Elementary Modern Physics) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. explain the notion of an inertial frame and the concept of an observer;
2. relate the limitations imposed by and consequences of motion of bodies at the speed of light;
3. state the principles of Special Relativity and use them to derive relations for time dilation and length contraction;
4. perform calculations using the Lorentz transformation formulae;
5. derive relativistic energy and momentum and use these to solve problems in mechanics;
6. apply the mathematical treatment of the wave function and Schrodinger's equation;
7. relate the atomic structure and energy associated with the particles of the atom;
8. apply the ideas of wave-particle duality and the uncertainty principle to solve problems in quantum mechanics;
9. apply the Bohr formula to calculate energies and wavelengths in the context of atomic hydrogen; and
10. explain the interaction of photons and electrons with matter.

**Course Contents**

Defects in Newtonian Mechanics. Galilean relativity. The speed of light. Inertial frames and the concept of an observer. The principles of Einstein's Special Theory of Relativity. Lorentz transformation. Time dilation and length contraction. Transformation of velocities. Doppler effect. Relativistic energy and momentum. Basic properties of atoms and molecules. Experimental basis of quantum theory. Electrons and quanta. Bohr's theory of atomic structure. Energy levels and spectra. De Broglie hypothesis. The uncertainty principle. Black body radiation. The momentum operator. Time-independent Schrödinger equation. The infinite square well. Simple applications in particle and nuclear physics. Compton effect. Thermionic emission. Radioactivity. Detection and measurement of charged particles (including the treatment of detectors). X-rays.

**PHY 202: Introduction to Electric Circuits and Electronics (2 Units C: LH 30)**

**Learning Outcomes**

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

1. identify circuit diagrams and symbols;
2. determine current flows, potential drops, power, and energy dissipation in circuits using Ohm's law;
3. simplify series and parallel combinations of resistors;

4. state Kirchhoff's laws and apply same in solving for currents and voltages in dc. and ac. circuits;
5. apply potential divider and current divider techniques in calculating circuit potential differences and branch currents;
6. state and apply circuit theorems and principles to solve problems;
7. apply the Mesh currents and Node – Voltage methods in network analysis;
8. discuss the nature of ac. currents and voltages in resistors, inductors, capacitors and determine impedances;
9. analyse A.C. circuits using phasor diagrams;
10. determine power, Q-factor, and resonance in ac. circuits;
11. explain the principle of the transformer and applications;
12. distinguish between conductors, semiconductors, and insulators and explain crystal and band structure;
13. identify semiconductor devices and explain their principle of operation;
14. explain the current – voltage characteristics of semiconductor devices; and
15. explain the function of semiconductor devices (diodes, transistors etc.)

**Course Contents**

D.C. Circuits. Sources of emf and current. Resistor combinations. Kirchhoff's Laws. Network analysis and circuit theorems. Mesh currents method, Node-voltage, Thevenin and Norton theorem, superposition principle. A.C. Circuits. Sinusoidal wave-forms. RMS and peak values. Power. Resistance, inductance and capacitance in a.c. circuits. Impedance and admittance. Series and parallel RLC circuits. Q factor. Resonance. The transformer. Electronics: filters. Amplification and the transistor. Bipolar junction and field effect transistors. Equivalent circuits. Amplifiers. Feedback. Oscillators. Signal generators. Semiconductors (devices and characteristics). The pnjunction. Simple diodes. Photodiodes. LEDs.

**PHY 204: General Physics VI (Waves and optics) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. describe the wave phenomena and explain the nature and properties of waves;
2. explain wave propagation in different media;
3. describe geometric optics and image formation;
4. analyse simple examples of interference and diffraction phenomena;
5. identify and explain functions of optical devices;
6. explain the principles of optical instruments and applications; 7. explain the principles of operation of the Michelson interferometer;
8. describe the polarization states of light.

**Course Contents**

Wave phenomena (types and properties of waves). SHM. Harmonic oscillator. Waves on a string. Energy in wave motion. Longitudinal waves. Standing waves. Acoustical

waves. Group and phase velocities. Doppler effects. Physical Optics: Spherical waves. Interference. Superposition. Young's slits. Single and double slits. Multiple slits. The Michelson interferometer. Diffraction. The diffraction grating and spectrometers. Thin films. Dispersion and scattering. Echo and beats. Sound in gases, liquids, and solids. Geometrical optics (waves and rays). Reflection at plane and spherical surfaces. Refraction. Thin lenses. Prism. Optical lenses and optical instruments e.g., microscopes, telescopes, etc. Lens maker's formula. Polarization and polarization states. Unpolarised and partially polarized light. Brewster's angle. Polarizing beam splitters. Photometry and light spectrum analysis.

**PHY 205: Thermal Physics (2 Units C: LH 30)**

**Learning Outcomes**

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

1. discuss the concept of heat and temperature;
2. explain and determine thermodynamic processes;
3. explain and evaluate properties of real and ideal gases;
4. evaluate the consequences of the thermodynamic laws;
5. describe the basis of the kinetic theory; and
6. describe the statistical behaviour of gases with applications.

**Course Contents**

The foundations of classical thermodynamics including the definition of temperature. The first law. Work, heat and internal energy. The second law. Carnot cycles and Carnot engines. Zeroth law. Entropy and irreversibility. Thermodynamic potentials and the Maxwell relations. Ideal gas equation. Internal energy and internal molecular modes. Qualitative discussion of phase transitions. Gibbs free energy. Clausius-Clapeyron equation. Examples of phase transitions. Van der Waals gas. Kinetic theory. Mean free path. Equi-partition of energy. Heat transfer. Diffusion rate.

**PHY 206: General Physics VII (Energy and Environment) (2 Unit C: LH 30)**

**Learning Outcomes**

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

1. explain the origin and sources of energy and power;
2. describe the inter relation and transformation of energy sources and types;
3. illustrate and explain the principles of generation of power;
4. outline the concept of energy demand and supply;
5. explain the economics, politics and problems associated with energy demand and supply;
6. identify and assess categories of environmental pollutants;
7. describe effect of carbon emission on global warming;

8. describe the environmental effect of energy generation, supply, and consumption; and 9. identify and evaluate the merits and demerits of power generation from different sources.

**Course Contents**

Energy sources and climate impacts. Energy requirements and consumption. Energy processing and conversion. Energy units and pricing. The greenhouse effect. Biological forms of energy (fossil fuels and biofuels). Basic nuclear physics. **T**he atom, radioactivity and decay laws. Interaction of radiation with matter. Nuclear fission principles and energetics. Chain reaction and dynamics. Reactor types and control. Current status of nuclear fission as a power source. Nuclear fusion principles and energetics. (Examples in stars and on earth). Thermonuclear fusion. Nuclear fuels. Ignition and the Lawson criterion. Magnetic and inertial confinement. Current status of nuclear fusion as a power source. Stellar fusion. Proton-proton chain and CNO cycle. Solar power technologies. Solar thermal. Solar photovoltaic. Wind energy. Nature of wind. Wind power and wind turbines. Betz criterion. Energy from waves and tides. Principles of water waves, energy, and power. Wave power extraction. Origin and properties of tides. Tidal stream power and tidal range power. Power from fluids. Hydro power. Energy transportation and storage. Thermal pollution. Energy costs, capacity, reserves, and efficiency. Emerging environmental effects of energy processing.

**PHY 207/208: General Practical Physics III & IV (2 Units C: PH 90)**

**Learning Outcomes**

Upon the completion of the course, the students should be able to:

1. identify physical quantities to be measured as independent and dependent variables;
2. determine the relationship between two variables in form of graph;
3. determine some physical constants such as acceleration due to gravity, force constant of a spring, refractive index of a prism and focal length of converging and diverging lenses using different methods; and
4. determine momentum of inertia of a fly wheel and determine coefficient of static and dynamic friction for wood.

**Course Contents**

The laboratory course consists of a group of experiments drawn from diverse areas of Physics (optics, electromagnetism, mechanics, Modern Physics, etc.). It is accompanied by seminar studies of standard experimental techniques and the analyses of famous and challenging experiments.

**PHY 213: Classical Physics I (2 Units C: LH 30)**

**Learning Outcomes**

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

1. relate the concepts of space coordinates, time, and linear motion;
2. describe particle dynamics, equilibrium, and conservative forces;
3. solve problems on central forces, energy, and angular momentum;
4. explain the dynamics of rotational motion;
5. discuss and apply the potential theory;
6. explain the dynamics of rigid bodies;
7. apply Newton's theory of gravitation to problems of planetary motion and space travel;
8. use inertial forces to explain motion from the viewpoint of rotating frames of reference; and
9. derive the general relation between the angular velocity and angular momentum of a rigid; body and use this to solve problems in rotational dynamics.

**Course Contents**

Introduction to classical mechanics. Space and time. Linear kinematics. Linear and angular momentum. Force and torque. Motion in a plane. Newtonian gravity. The two-body systems. Forces and equilibrium. Particle dynamics. Force fields and potentials. Collisions. Conservative forces. Inertial frames and non-inertial frames. Motion in rotating frames. Centrifugal force. Central force motions. Kepler's motion in a central force field. Particle orbits as conic sections. Kepler's laws. Rigid body motion and rotational dynamics. Moment of inertia. Free rotation and stability. Gyroscopes.

**PHY 214: Classical Physics II (Electrodynamics) (2 Units C: LH 30)**

**Learning Outcomes**

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

1. use scalar and vector potentials and explain the concept of gauge invariance;
2. demonstrate the compatibility of electrodynamics and special relativity;
3. use Lorentz covariant formalism in the context of electrodynamics and special relativity;
4. solve Poisson's equation and the inhomogeneous wave equation;
5. distinguish between radiation fields and other electromagnetic fields; and
6. calculate the radiated power produced by accelerating charges.

**Course Contents**

Maxwell's equations and wave solutions. Definition of scalar and vector potentials. Electrostatics and magnetostatics and Poisson's equation. Electrodynamics in Lorentz Gauge. the inhomogeneous wave equation and the retarded time. Relativistic dynamics. Electromagnetic field tensor. Power radiated from an arbitrary moving

charge. Multiple radiation, electric and magnetic dipole radiation; slow-down of pulsars. Rayleigh and Thomson scattering.

**PHY 211: Workshop Practice (2 Units C: LH 15; PH 45)**

**Learning Outcomes**

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

1. identify safety signs for various workshop types and abide by the underlining regulations while working in the workshop;
2. handle workshop tools and machineries;
3. illustrate simple metal processing methods;
4. describe the criteria for selection of construction materials;
5. identify electrical and electronic devices and explain some instrumentation techniques for measuring parameters;
6. explain types and methods of wood and plastic processing.

**Course Contents**

Workshop layout and safety. Basic hand tools and bench work practices. Measurement and gauging. Sheet metal operations. Casting. Cutting, drilling, turning, and milling. Metal joining devices and adhesives in common use. Soldering techniques and wrap joints. Plain and cylindrical generation of smooth surface using power operated machines. Criteria for selection of materials used for construction (metallic and non-metallic). Instrumentation and measuring techniques. Multi-meters and oscilloscopes. Extension of instrument range. A survey of the use of electronic circuit devices (e.g., diodes, transistors including FET, integrated circuits). Photocells. Basic circuit development and analysis. Wood logging. Wood types and processing. Plastic types and working. Plastic moulding, bending, and encapsulation.

**LMU-PHY 201: Principles of Remote Sensing (2 Units C: LH 30)**

**Senate Approved Relevance**

Remote sensing plays critical roles in the advancement of technology in the 21st Century. It is the backbone of modern navigation systems and it is widely used for military surveillance and defence, weather monitoring and forecasting, urban and regional planning, mineral and geothermal exploration, agricultural surveys, among others. In order to meet the demands of our world today and the vision and missions of Landmark University in harnessing the hidden treasures of the mother-earth and producing pathfinders, there is need to understand the principles of remote sensing and their applications. This course is designed to provide students the basic understanding of remote sensing and digital image processing technologies, and as well, their applications.

**Overview**

This focuses on the theoretical and practical aspects of remote sensing, which is the science of acquiring information about the Earth's surface without physically being present at the location. This course will provide students with a comprehensive understanding of the fundamental principles and practical applications of remote sensing. Apart from Physics and geophysics, the knowledge of the physics principles of remote sensing is highly relevant to fields such as geography, environmental science, natural resource management and geospatial analysis.

The course covers a wide range of topics related to remote sensing, including: principles of electromagnetic radiation and how it interacts with the Earth's atmosphere and surface; Sensors and platforms, which deals with the various types of remote sensing sensors and platforms, such as satellites, aircraft and drones, their characteristics and applications; data acquisition and processing, which examines the process of acquiring and processing remote sensing data, including data corrections, calibration and image enhancement; image interpretation and analysis, which focuses on how to interpret and analyse remote sensing images using various techniques; and various applications of remote sensing in fields such as agriculture, forestry, urban planning, environmental monitoring, and disaster management.

**Objectives**

The objectives of this course are to:

1. explain the fundamentals of remote sensing;
2. illustrate the linkage between remote sensing and GIS;
3. state the advantages and limitations of remote sensing;
4. illustrate remote sensing process;
5. explain electromagnetic energy interaction between atmosphere and earth surface;
6. explain various remote sensing systems and their techniques;
7. describe the spectral reflectance signature of earth materials;
8. explain the remote sensing data acquisition process, storage, correction, image processing and interpretation; and
9. discuss the applications of remote sensing.

**Learning Outcomes**

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

1. describe the principle of remote sensing;
2. describe at least two (2) different tools used in remote sensing;
3. describe the spectral signature of radiation from natural and human made materials;
4. demonstrate skills in data collection and analysis;
5. explain various applications of remote sensing in surveying of natural resources, combating potential environmental hazards, and monitoring land usage.

**Course Contents**

Basic principle of remote sensing. Relationship between remote sensing and geographic information system. Importance and limitations of remote sensing. Remote sensing process. Sensor systems. Optical remote sensing. Thermal infrared remote sensing. Radar, lidar, sonar remote sensing. Satellite remote sensing.

Radiation theory. Spectral signature of natural and human made materials. Data acquisitions, storage and analysis. Global Positioning System (GPS). Applications of remote sensing principles and data to environmental sciences, weather and climate, hydrology, oceanography, urban planning, agriculture, vegetation, soil and land cover.

**Minimum Academic Standards**
None.

**PHY 202: Physics of Solar Radiation and the Earth's Atmosphere**
**(2 Units C: LH 30)**

**Senate Approved Relevance**
The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to a role in driving the much-needed food security in Nigeria is the quest for Landmark University's vision and mission. Consequently, the relevance of Physics in sustainable Agriculture is vital, particularly the role of the atmosphere in weather and climate. Hence, the need for a basic understanding of the role of radiation and the atmosphere in the earth's heat energy balance.

**Overview**
Physics of Solar Radiation and the Earth's Atmosphere is a field of study that focuses on the interaction between the sun's radiation and the Earth's atmosphere. The discipline aims to understand the physical processes that govern the transport, absorption, and scattering of solar radiation in the Earth's atmosphere. This field of study is essential in understanding climate change and weather patterns, as the behaviour of solar radiation in the atmosphere is a critical factor in determining the temperature and weather conditions on the Earth's surface.

Overall, the study of the physics of solar radiation and the Earth's atmosphere plays a critical role in our understanding of the natural processes that shape our environment and helps us to make informed decisions about the management of the Earth's resources. Therefore, this course would introduce students to the concept of the Sun, its composition, energy transfer, its interaction with the earth's atmosphere. Likewise, they would be exposed to the physics of the atmosphere; its structure and composition, and other fundamentals of the atmosphere.

**Objectives**
The objectives of this course are to:
1. describe the sun and mechanism of the sun's radiant energy;
2. identify the spectrum of solar radiation in order of increasing wavelength;
3. value the uniqueness of the different laws of radiation;
4. outline the different instruments for measuring solar radiation.
5. recall concept of the atmosphere, its structure and composition;
6. describe the concept of lapse rate, temperature and pressure variation with altitude;
7. list the different atmospheric variables and their observational tools.

**Learning Outcomes**
At the end of this course, students should be able to:
1. describe the sun and the mechanism for its emitted radiation;
2. state and proof the four (4) laws of radiation;
3. explain the different effects of the atmosphere on solar irradiance;
4. identify the two (2) instruments for measuring the solar irradiance
5. describe the structure of the earth's atmosphere based on temperature and composition;
6. list and describe three (3) atmospheric parameters and their measurements;
7. describe the variation of the atmosphere with respect to the lapse rate;
8. describe scale height and its relationship with pressure variation with altitude;
9. explain the concept of atmospheric stability.

**Course Contents**
Solar radiation. Properties and laws of radiation. Radiation and absorption. Blackbody radiation. Spectral distribution of radiant energy. The Sun and its radiation. Solar constant: measurements and calculation. Radiation sensors. Direct and global solar irradiance. Instruments and measurements of radiation. Structure of the atmosphere. Measurements of atmospheric variables (e.g. density, pressure, and temperature). Variation of atmospheric variables with altitude. Equation of state of dry air and moist air. Volume and mass mixing ratio. Hydrostatic equation.

**Minimum Academic Standards**
None.

**LMU-PHY 203: Basic Physics of the Solid Earth (2 Units C: LH 30)**

**Senate Approved Relevance**
The vision of Landmark University is to be a leading world class university, by spearheading an agrarian revolution on the African continent through the exploration of hidden treasures in the mother-earth thereby restoring the dignity of the black race. In order to explore the hidden treasures in the earth, it is essential to understand the basic physics of the solid earth.

**Overview**
This course covers the physics of the solid earth from the surface to the core. It covers a wide range of topics related to the structure, composition, dynamics and evolution of the Earth's interior. The course explores the solar system, the physical processes that formed our planet Earth, physics of elastic wave propagation in the Earth (seismology), the Earth's gravitational and magnetic fields (including the structure of the earth and rock magnetism), heat flow and other dynamics of the Earth to unravel the properties, processes, and structure of the Earth's interior.

This course will prepare students for geophysics courses and other Earth related physics courses. This course is highly relevant to fields such as geology, geophysics, planetary science, natural hazards research and other related fields.

**Objectives**
The objectives of this course are to:
1. introduce the Earth and its solar system;
2. summarise the origin of the Earth, its age and geochronology;
3. describe the layers of the Earth's interior;
4. explain seismic waves and state the properties of different types of Earth's seismic waves;
5. describe the causes of earthquakes and seismic zones of the Earth;
6. state the law of gravitation;
7. explain the Earth's gravity field and structure of the Earth;
8. describe the Earth's magnetic field and rock magnetism;
9. explain the dynamics of the Earth, focusing on polar wandering, continental drift, plate tectonics, geomagnetic reversal, seafloor spreading, volcanism, metamorphism, sedimentation and hydrological cycle; and
10. state geophysical and/or geological case studies such as the geology of Nigeria, global seismicity and post seismic hazards, etc.

**Learning Outcomes**
At the end of this course, students should be able to:
1. describe the earth's interior structure and the internal forces that take place within the earth interior, geophysical fluids and environmental hazards;
2. explain the ancient key geological event;
3. explain body and surface seismic waves;
4. explain geodynamo;
5. mention at least three (3) magnetic properties of rocks;
6. compare geomagnetic field observations and discuss the effects of magnetic storms.

**Course contents**
The Solar System. The Earth's History. The Earth's interior. Seismicity and Earthquake zones. the Earth's gravity field. Figure of the Earth. The Earth's magnetic field. Rock magnetism. Polar Wandering. Continental Drift. Plate Tectonics. Seafloor Spreading. Volcanoes. Rock Cycle. Glaciation. Groundwater. Heat flow. Case studies.

**Minimum Academic Standards**
None.

## LMU-PHY 204: Introduction to Numerical Analysis (2 Units C: LH 30)

**Senate Approved Relevance**
The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to a role in driving the much-needed food security in Nigeria is the quest for Landmark University's vision and mission. Consequently, the relevance of Physics in sustainable Agriculture is vital, particularly the role of the atmosphere in weather and climate. Hence, the need for a skill in numerical analysis, which would enhance modeling and forecasting efforts.

**Overview**
The study of numerical analysis involves the use of computer software and programming languages to implement numerical methods, analyze their accuracy and efficiency, and develop new algorithms. Numerical analysts also study the limitations and potential sources of error in numerical methods and develop techniques to address them. It plays a critical role in scientific and engineering research, enabling scientists and engineers to solve complex problems that would be otherwise intractable.

Applications of numerical analysis include weather forecasting, computational fluid dynamics, computer graphics, optimization, and data analysis. The field is also relevant to many areas of physics, including quantum mechanics and relativity, where numerical simulations are essential for studying complex physical systems.

**Objectives**
The objectives of this course are to:
1. describe the fundamental concepts and techniques of numerical computation for solving mathematical problems;
2. develop an understanding of methods for solving non-linear equations;
3. explain the fundamental principles of finite difference operators and their application in numerical computation;
4. introduce techniques for interpolation and approximation of functions;
5. use numerical analysis in solving mathematical problems;
6. explain the fundamental principles of curve fitting and least squares, and their application in numerical computation;
7. review linear programming and its application in optimization.

**Learning Outcomes**
At the end of this course, students should be able to:
1. use numerical computation to solve mathematical problems;
2. use numerical methods to solve non-linear equations;
3. construct finite difference schemes and understand their properties;
4. apply interpolation and approximation techniques to solve mathematical problems;
5. use numerical integration to solve problems in physics;

**Course Contents**
Introduction to numerical computation. Solution of non-linear equations. Solution of simultaneous linear equations. Direct schemes. Iterative schemes. Finite difference operators. Interpolation. Approximation. Numerical differentiation. Quadrature. Numerical solution of ordinary differential equations. Introduction to Numerical Analysis. Numerical Integration. Curve fitting. Least squares. Introduction to linear programming. Some applications.

## LMU-PHY 205: MATLAB for Physics Students (1 Units C: PH 45)

### Senate Approved Relevance

One of missions of Landmark University's is to raising a generation of solution providers through a qualitative and life-applicable training system that focuses on value and creative knowledge. The purpose of this course is to equip physics students with the practical skills and knowledge of a programming language that is widely used for solving scientific problems. By equipping the students with MATLAB skills, Landmark University is preparing them to contribute to the development of technology-driven products and services, conduct cutting-edge research, and contribute to the sustainable socio-economic development of Nigeria.

### Overview

This is a course that teaches physics students how to use MATLAB software to solve physics problems and conduct data analysis. MATLAB is a powerful tool widely used in scientific research, engineering, and finance for data visualization, numerical analysis, and algorithm development.

The course is designed to teach students how to write and execute MATLAB code to perform various tasks related to physics, including plotting functions and data, solving differential equations, and performing simulations. The course covers topics such as vectors and matrices, plotting, programming constructs, the use of built-in functions, data analysis, including data manipulation, curve fitting, and statistical analysis, which are important skills for physics research. Additionally, the course may include lab exercises that involve using MATLAB to solve physics problems and analyze data.

Overall, the course is designed to help physics students develop the necessary computational skills to conduct research in their field. MATLAB is a widely used tool in the scientific community, and proficiency in its use can help students in their future careers in physics, engineering, and other related fields.

### Objectives

The objectives of this course are to:

1. recognize MATLAB as a scientific and user-friendly programming interface;
2. identify the features of MATLAB;
3. identify and differentiate commands from functions and use them in real problem solving;
4. use the arithmetic operators along with scalars, vectors, and matrices, in solving numerical problems;
5. illustrate data in different graphical formats with detailed information;
6. write simple MATLAB codes for numerous applications.

### Learning Outcomes

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

1. identify at least three (3) main features of MATLAB such as the scalar, vectors, importing, graphical user interface (GUI);
2. differentiate commands from functions;
3. arrange the basic arithmetic operators in their order of precedence;
4. create at least three (3) variables using the applicable;

5. generate a line vector and a 3 x 3 matrix using the MATLAB script;
6. write at least five (5) executable MATLAB expressions and statements;
7. plot different 2-dimensional and 3-dimensional figures (such as mesh, surface, etc.);
8. apply title, axes, legends in the plots and in GUIs designs;
9. state two advantages of MATLAB computation in simplifying mathematical operations.

**Course Contents**
Definition, brief history, and overview of MATLAB. Main MATLAB features and applications. MATLAB desktop and command window. MATLAB syntax and programming concepts. Data types and variables. Functions. Basic arithmetic and logical operators. Intrinsic functions. Scalars and vectors. Matrices and arrays. Importing and exporting data. Manipulating data and arrays. Graphics (data visualization and plotting. 3D visualization. Programming (Control flow statements, functions and subroutines; debugging and error handling; MATLAB toolboxes and libraries. Desktop tools and development environment. Solving mathematical problems. Applications in communications, control system, filter design, time series, bioinformatics, signal processing, imaging, mapping, etc.

**Minimum Academic Standards**
Personal computers (PCs) with MATLAB application installed for each student.

**LMU-TMC 211: Total Man Concept III (1 Unit C: LH 15)**

**Senate Approved Relevance**
This course is in line with the vision and mission of the Landmark University, which include the development of breadwinners and solution providers that will surmount the problems and challenges facing the African continent. However, several qualities (including a healthy self-esteem) are required of any individual that will emerge as an effective leader and some of these have been packaged into LMU-TMC211. To this end, it will be proper for senate approval.

**Overview**
This course begins with an introduction. It is intended to expose the students to see the need to see self-esteem as a requirement for the building of a positive self-image. Self-esteem is then explained from different contexts. LMU-TMC211 explains the various ways of building or inculcating healthy self-esteem. It explains the roles of self-esteem in a nation building. It also discusses the challenges which affect the building good self-esteem and presents the ways of overcoming them.

The focus of LMU-TMC221 is the identification of building blocks of self-esteem. The course presents the importance of self-motivation, the power of focus and personal profit building amongst others. Since self-esteem is a function of many factors, the major building blocks of self-esteem are also packaged into this course to help students to overcome challenges such as inferiority complex and therefore live a successful life.

**Objectives**
The objectives of this course are to:
1. describe the concept of self-esteem;
2. state the importance of healthy self-esteem;
3. describe the various ways of improving self-esteem;
4. outline the building blocks of self-esteem;
5. describe the challenges that oppose the building of a healthy self-esteem;
6. outline how to build networks for academic success;
7. describe creativity dynamics.

**Learning Outcomes**
At the end of this course, students should be able to:
1. describe the concept of self-esteem;
2. state at least two (2) importance of healthy self-esteem;
3. describe at least two (2) ways of improving self-esteem;
4. outline five (5) building blocks of self-esteem;
5. describe at least two (2) challenges that oppose the building of a healthy self-esteem;
6. describe creativity dynamics.

**Course Contents**
Understanding Self-Motivation and Personal Development I. Health Talk. Understanding Self-Motivation and Personal Development II. Building networks for academic success. Understanding Vision and Gods Divine Plan. Creativity dynamics. Personal Profit Building. Building Boundaries and Bridges. Building blocks of self-esteem. Essential of Life-Long Learning. The power of Focus. Building Networks and skills for self-empowerment.

**Minimum Academic Standards**
None.

**LMU-TMC 221: Total Man Concept IV (1 Unit C: LH 15)**

**Senate Approved Relevance**
Success is the desire of every man and woman. However, many people do not attach the right definition to success. This makes some people to seek for money via dubious means stating that 'the end justifies the means'. However, Landmark University, being a vision-driven institution teaches the right concept of success to students. This will help the students to emerge as successful pathfinders and build successful companies in the very near future. Hence, the relevance of this course is approved by senate.

**Overview**
This course begins with an introduction. It exposes the students to different people who have been described as successful. It then defines and discusses the term success. The course explains worldly success and biblical success. It then provides a template or parameter for success. It looks at the secrets of success.

LMU-TMC221 discusses the places of diligence, discipline, forbearance, honesty, commitment, and above all, the place of the help of God in success. References are made to some successful men of God, both then (Abraham, Joseph) and now (Bishop David Oyedepo, Pastor E.A. Adeboye).

**Objectives**

The objectives of this course are to:

1. define the concept of success;
2. discuss the importance of success in the life of an individual;
3. evaluate the notion of people about success;
4. list the parameters that can measure success;
5. outline some secrets of success;
6. outline successful people in the Bible;
7. describe the role of commitment and hard-work in success.

**Learning Outcomes**

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

1. define the concept of success;
2. state at least two (2) the importance of success in the life of an individual;
3. state two (2) definitions that reveal the wrong notion that people have about success;
4. outline at least two (2) parameters that can measure success;
5. list at least five (5) secrets of success;
6. list at least ten (10) successful people in the Bible;
7. describe the role of commitment in success.

**Course Contents**

Introduction to LMU-TMC221. Success Parameters. Definitions of Success. Pillars of Success in Scriptures. Success secrets-The Place of Work. Success secrets-The Place of Endowment. Success secrets-The Place of Commitment. Success secrets-The Place of Character. Success secrets-The Place of Planning. Developing your personal Mission statement for Success. Biblical examples of Success 1. Biblical examples of Success 2.

**Minimum Academic Standards**

None.

## 300 Level

### GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

**Learning Outcomes**

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

1. analyse the concepts of peace, conflict, and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies;

5. describe roles of international organisations, media, and traditional institutions in peace building.

**Course Contents**

Concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic and geo-political conflicts. Structural conflict theory, realist theory of conflict and frustration-aggression conflict theory. Root causes of conflict and violence in Africa: indigene and settlers' phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations, selected conflict case studies – Tiv-Junkun, Zango Kartaf, chieftaincy and land disputes and many more. peace building, management of conflicts and security, peace & human development. Approaches to peace & conflict management: (religious, government, community leaders and many more.). Elements of peace studies and conflict resolution, conflict dynamics assessment scales: constructive & destructive. Justice and legal framework and concepts of social justice. The Nigeria legal system. Insurgency and terrorism. Peace Mediation and Peace Keeping. Peace and security council (international, national and local levels). Agents of conflict resolution: conventions, treaties, community policing, evolution and imperatives. Alternative dispute resolution (ADR): a). dialogue b). arbitration c). negotiation d). collaboration and many more Roles of international organizations in conflict resolution: (a). The United Nations (UN) and its conflict resolution organs. (b). The African Union & Peace Security Council (c). ECOWAS in peace keeping. Media and traditional institutions in peace building. Managing post-conflict situations/crisis: refugees. internally displaced persons (IDPs). The role of NGOs in post-conflict situations/crisis.

**ENT 312: Venture Creation (2 Units C: LH 15; PH 45)**

**Learning Outcomes**

At the end of this course, students, through case study and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors regardless of geographical location;
3. state how original products, ideas, and concepts are developed;
4. develop business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises.
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; 9. appreciate why ventures fail due to lack of planning and poor implementation.

**Course Contents**

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, Micro finance, Personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, first mover advantage, Ecommerce business models and successful E-commerce companies,). Small business management/family business; leadership & management, basic book keeping, nature of family business and family business growth model; negotiation and business communication (Strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, Idea pitching); technological solutions (the concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), blockchain, cloud computing, renewable energy etc. Digital Business and E-commerce strategies).

**PHY 301: Analytical Mechanics I (2 Units C: LH 30)**

**Learning Outcomes**

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

1. explain and evaluate particle motion in one, two, and three dimensions;
2. describe the two-body problem and many body systems;
3. define and solve problems of conservative forces;
4. explain Newton theory of gravitation;
5. describe the nature of generalized motion;
6. explain the theory of relativity;
7. choose an appropriate set of generalized coordinates to describe a dynamical system and obtain its Lagrangian in terms of those coordinates and the associated 'velocities'; and
8. derive and solve the corresponding equations of motion. Treat small oscillations as an eigenvalue problem.

**Course Contents**

Review of Newtonian Mechanics. Motion of a particle in one, two and three dimensions. Internal forces. External forces. Forces of constraint. Systems of particles and collision theory. Newtonian gravitation; conservative forces and potentials, oscillations, central force problems; accelerated frames of reference. Rigid body dynamics. Rotational problems and space coordinates. Mechanics of continuous media. Galilean relativity. Relativistic kinematics and dynamics. Applications of relativistic kinematics.

**PHY 303: Electromagnetism (3 Units C: LH 45)**

**Learning Outcomes**

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

1. derive Maxwell's equation set from the empirical laws of electromagnetism;
2. use the fundamental laws of electromagnetism to solve simple problems of electrostatics, magnetostatics and electromagnetic induction in a vacuum;
3. modify Maxwell's laws to apply in the presence of materials and solve problems involving them;
4. derive the electromagnetic boundary conditions which apply at the interface between two simple media, and to use them to solve problems involving two or more materials;
5. explain the properties of plane electromagnetic waves in a vacuum and in simple media and to be able to derive these properties from Maxwell's equations;
6. apply the special theory of relativity to problems in electromagnetism.

**Course Contents**

Review of Vector calculus. Electrostatics and Magnetostatics. Magnetization and magnetic susceptibility. Laplace's equation and boundary value problems. Multipole expansions. EM waves in dielectric and magnetic materials. Polarization of EM waves. Electromagnetic induction. Faraday's and Lenz's laws. A.C. Circuits. Maxwell's equations. Lorentz covariance and special relativity. Gauss theorem in dielectrics. Poisson's equations. Uniqueness theorem. Magnetic properties. Motors. Generators. Poynting vectors.

**PHY 304: Electromagnetic Waves and Optics (3 Units C: LH 45)**

**Learning Outcomes**

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

1. explain plane electromagnetic waves and waves propagation;
2. derive the wave equation;
3. describe the transport of electromagnetic energy;
4. explain scattering, interference, diffraction, reflection, polarization, and refraction of electromagnetic waves;
5. use complex notation competently for wave phenomena;
6. solve problems which require the use of wave representations of electric and magnetic fields in propagating electromagnetic waves;
7. analyse simple examples of interference and diffraction phenomena;
8. explain the principles of operation of a range of equipment used in modern optics, notably the Michelson interferometer and Fabry-Perot etalon;
9. explain the physics of the laser and processes involved in producing laser radiation to solve simple problems;

**Course Contents**

Review of Maxwell's equations and wave equations in a dielectric. Electromagnetic potentials. Propagation of plane and spherical waves. Huygen's wavelets and Fermat's principle. Recap of polarization states. Interference. Michelson interferometer and Fabry-Perot etalon. Fourier transform spectroscopy. Young's slits. Lloyd's mirror. Fraunhofer diffraction. Resolution of optical instruments. Reflection and refraction. Transmission lines. Wave guides and optical cavities. Lasers (rate equation, Steady state operation; threshold and efficiency).

**PHY 305: Quantum Physics (3 Units C: LH 45)**

**Learning Outcomes**

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

1. explain the origin of quantum physics and principles of quantum theory;
2. apply the mathematical tools of quantum physics;
3. explain how quantum states are described by wave functions;
4. apply operators and solve eigenvalue problems in quantum mechanics;
5. solve the Schrodinger equation and describe the properties of the simple harmonic oscillator;
6. use the algebra of angular momentum operators and solve the simple eigenvalue problems of an angular momentum in quantum mechanics;
7. apply quantum mechanics to describe the hydrogen atom;
8. employ quantum mechanics to describe the properties of one-electron atoms;
9. use quantum mechanics to describe the simple multi-electron systems such as helium atom and hydrogen molecule.

**Course Contents**

Wave-particle duality and the uncertainty principle. Basic principles of the quantum theory. Time dependent Schrodinger equation. Energy levels and potential wells. Reflection and transmission of potential barriers. Operators and quantum states. Commutation relations and compatibility of different observables. Orbital angular momentum. Particle in two dimensions. Familiar wave phenomena and their associated wave equations. Physical interpretation of the wave function as a probability amplitude. Energy levels and stationary states. Energy bands in periodic lattice. Solution of Schrodinger equation for a central potential in three dimensions. The hydrogen atom. Multi-electron atoms. The harmonic oscillator. Exchange symmetry.

**PHY 306: Statistical and thermal physics I (2 Units C: LH 30)**

**Learning Outcomes**

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

1. describe an ideal gas on the basis of classical statistics;
2. explain the basic concepts of statistical mechanics, including entropy, its statistical interpretation and relation to disorder, and the statistical origin of the second law of thermodynamics;
3. illustrate the canonical and grand-canonical partition functions for systems in thermal equilibrium and use them to obtain thermodynamic quantities of interest;
4. describe the implications of the indistinguishability of particles for systems of non-interacting quantum particles;
5. deduce the Bose-Einstein and Fermi-Dirac distribution functions and apply them to calculate the properties of Bose and Fermi gases, for example in the context of white dwarf stars and black-body radiation; and
6. explain the physical origin of Bose-Einstein condensation, to characterize it quantitatively, and to explain the experiments confirming Bose-Einstein condensation

**Course Contents**

Basic theory of thermodynamics. Basic of probability theory. Microstates and macrostates. The concept of ensembles. Statistical interpretation of entropy and temperature. Isolated systems and the microcanonical ensemble. Statistical physics of non-isolated systems. Derivation of the Boltzmann distribution and canonical ensemble. The partition function in thermodynamics. Noninteracting systems. Equipartition theorem. Density of states. Grand canonical ensemble. FermiDirac and Bose-Einstein distributions. The ideal Fermi gas. Fermi energy. Heat capacity. The ideal Bose gas. Black body radiation. Bose-Einstein condensation.

**PHY 307/308: General Practical Physics V & VI (2 Units C: PH 90)**

**Learning Outcomes**

On completion, the students should be able to:

1. verify some equations, physical laws and theorems;
2. identify apparatus, design and set up experiments;
3. investigate relationships between physical quantities numerically and graphically; and
4. prepare and present laboratory reports.

**Course Contents**

A year-long series of mini courses on important experimental techniques. Topics covered include electronics, optics, electricity, atomic, molecular nuclear and low temperature physics, statistics and data handling and scientific writing.

**PHY 311 Complex Variable and Vector Space (3 Units C: LH 45)**

**Learning Outcomes**

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

1. determine whether or not a given function of a complex variable is differentiable;
2. use conformal mappings of the complex plane to solve problems in 2D electrostatics, fluid flow and heat flow;
3. construct the Taylor-Laurent series for functions that are analytic in an annular region of the complex plane;
4. determine the location and nature of the singularities of a function and determine the order of a pole and its residue;
5. use the residue theorem to evaluate integrals of functions of a complex variable, and identify appropriate contours to assist in the summation of series and the evaluation of real integrals; 6. find an orthonormal basis for a given vector space;
7. define the adjoint of a linear operator and determine whether a given operator is Hermitian and/or unitary; and
8. employ methods from this and prerequisite units to solve previously unseen problems in linear algebra, using Dirac's notation where appropriate.

**Course Contents**

Complex numbers. Functions of complex variable. Functions as mappings. Complex differentiation, analytic functions and the Cauchy-Riemann equations. Conformal mappings. solutions of 2D Laplace equation in physics. Integration in the complex plane. Contour integration. Cauchy's Theorem. Cauchy's integral formulae. Taylor and Laurent Series. Cauchy's residue theorem. Real integrals and series. Vector spaces. (Abstract vector spaces, linear independence, basis and dimensions, representations, Inner products, linear operators). Hermitian and unitary operators. Eigenvalues and eigenvectors.

**PHY 318: Semiconductor Devices (3 Units C: LH 45)**

**Learning Outcomes**

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

1. explain the type, functionality, and operation of semiconductor devices;
2. distinguish between conductors, semiconductors, and insulators;
3. describe the crystal structure of representative semiconductor diodes and amplifying devices;
4. describe the operation of semiconducting devices in a circuit;
5. be familiar with semiconductor device packaging and symbol representations;
6. recognize the functional operation of diodes and amplifying semiconductor devices;
7. describe how to test semiconductor devices and evaluate their status;
8. describe forward and reverse bias characteristics of diodes;
9. explain voltage-current characteristics of semiconductor devices;
10. explain the physics and operation of the transistors;

11. describe metal - semiconductor junction characteristics;
12. explain the basics of FET's and MOSFET's structures; and
13. state the principle of operation of photonic devices.

**Course Contents**

Classes of semiconductor. The physics of semiconductors. Band structure of metals, semiconductors, and insulators. Semiconductor equilibrium. Doping and statistics. Carrier distribution, transport, and recombination. Carrier drift, diffusion, and conductivity. Hall effect. semiconductor growth. Semiconductor quantum structures. Modelling and application of selected semiconductor devices. P-n junction. Review of junction and bipolar transistor physics. Major emphasis on MOS devices including field effect transistors and charge coupled devices. Consideration of advanced bipolar structures. Schottky barrier devices. Optical properties of semiconductors (light emitting diodes and photo-detectors). Solar cells.

**PHY 399: Industrial Attachment II (12 weeks) (3 Units C)**

**Learning Outcomes**

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

1. develop practical skills of the theories learned in the classroom;
2. acquire working experience of the industries;
3. handle relevant tools and equipment in the industries; and
4. write technical reports on their industrial work and present seminar.

**Course Contents**

Students should be attached to some relevant organizations for additional 12 weeks at the 300 level for the four (4) year program preferably during the long vacation, and for 24 weeks at the 400 Level for the five (5) year B.Tech. program during the second semester and the long vacation for more industrial experience training. Students to be assessed based on seminar presentation, technical reports, and assessment by supervisors.

## 400 Level

**PHY 401: Quantum Mechanics I (3 Units C: LH 45)**

**Learning Outcomes**

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

1. state the postulates of quantum mechanics;
2. explain the basics of vectors and tensor operators;
3. solve a variety of physical problems using the Schrodinger equation;
4. work with angular momentum operators and their eigenvalues both qualitatively and quantitatively;

5. explain electron spin and the Pauli principle; and
6. apply perturbation theory and other methods to find approximate solutions to problems in quantum mechanics, including the fine-structure of energy levels of hydrogen.

**Course Contents**

The formulation of quantum mechanics in terms of state vectors and linear operators. Time evolution of the Schrodinger equation. The theory of angular momentum and spin. Electron spin and the Stern-Gerlach experiment. Identical particles and the Pauli exclusion principle. Multielectron atoms. Approximation methods. Variational methods and WKB approximation for bound states and tunnelling. Time - independent perturbation theory. The fine structure of hydrogen. Harmonic oscillator. Creation and annihilation operators. External fields. Zeeman and Stark effects in hydrogen.

**PHY 402: Quantum Mechanics II (3 Units C: LH 45)**

**Learning Outcomes**

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

1. apply the mathematical tools of quantum mechanics;
2. recognise approximation methods in quantum mechanics;
3. explain the scattering theory;
4. identify the unitary transformations linked to symmetry operations;
5. apply time-dependent perturbation theory to variety of problems;
6. derive a mathematical description of quantum motion in electromagnetic fields;
7. apply the relativistic wave equations to simple single-particle problems; and
8. use Dirac notation to represent quantum-mechanical states and manipulate operators in terms of their matrix elements.

**Course Contents**

Time-independent and time-dependent perturbation theory. Scattering theory. Elastic potential scattering. Green's function and partial wave methods. Symmetries in quantum mechanics. Rotations, space-time reflections and parity. Selection rules for atomic transitions. Emission and absorption of radiation. Selection rules for hydrogen. Description and interpretation of selected phenomena from each of atomic physics, molecular physics, solid-state physics, and nuclear physics using quantum mechanical models. Relativistic wave equation. The Klein-Gordon equation. The Dirac equation. Chirality. Lorentz invariance and non-relativistic limit.

**PHY 403: Mathematical Methods for Physics I: (3 Units C: LH 45)**

**Learning Outcomes**

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

1. explain the concepts of scalar and vector fields;

2. describe the properties of div, grad and curl and be able to calculate the divergence and curl of vector fields in various coordinate systems;
3. calculate surface and volume integrals in various coordinate systems;
4. calculate flux integrals and relate them to the divergence and the divergence theorem;
5. calculate line integrals and relate them to the curl and to Stokes' theorem;
6. apply the methods of vector calculus to physical problems; and
7. calculate the fourier series associated with simple functions and apply them to selected physical problems.

**Course Contents**

Vector and scalar fields. Vector operators. Div, grad, and curl. Divergence theorem. Stoke's theorem. Linear Algebra and functional Analysis. Transformations in linear vector spaces and matrix theory. Hilbert space and complete sets of orthogonal functions. Special functions of mathematical physics (The gamma function; hypergeometric functions; Legendre functions; Bessel functions. Hermite and Laguerre functions. The Dirac - Delta function. Integral transforms and fourier series. Fourier series and fourier transforms. The Dirichlet conditions. orthogonality of functions. Fourier coefficients. Complex representation of fourier series. Laplace transform. Applications of transform methods to the solution of elementary differential equations of interest in physics and engineering.

**PHY 404: Mathematical Methods for Physics II (3 Units C: LH 45)**

**Learning Outcomes**

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

1. describe the properties of different types of functions and be able to sketch them in both 2D Cartesian and polar coordinates;
2. integrate and differentiate functions of one variable using a range of techniques and be able to apply integration and differentiation to a range of physical problems;
3. show how smooth functions can be expressed in terms of power series;
4. explain the properties of complex numbers and construct some basic complex functions;
5. employ matrix notation, carry out matrix algebra and use matrices to solve systems of linear equations;
6. compute the properties of determinants, be able to evaluate them, and use them to test for unique solutions of linear equations; and
7. solve first and second order ordinary differential equations using a range of techniques.

**Course Contents**

Partial differential equations. Solution of boundary value problems of partial differential equations by various methods which include separation of variables, the method of integral transforms. Sturm-Liouville theory; uniqueness of solutions.

Calculus of residues and applications to evaluation of integrals and summation of series. Applications to various physical situations, which may include, electromagnetic theory, quantum theory, diffusion phenomena; complex variable theory and their relation to selected physical problems. Complex differentiation and integration. Cauchy's theorem. Taylor's and Laurent's series. Ordinary differential equations of first and second order and their physical applications. Homogeneous partial differential equations.

**PHY 405: Physics Entrepreneurship (2 Units C: LH 15; PH 45)**

**Learning Outcomes**

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

1. develop creative ability to apply physics knowledge to real-world settings;
2. generate ideas of innovation and entrepreneurship; and
3. apply entrepreneurial skills and mindset in approaching societal problems.

**Course Contents**

Creativity. Developing questioning attitude. Concept development. Reconstructionism. Critical thinking and brainstorming. Use of practical and creative techniques in concept development. Identifying underlining physics principles in real life situations and physics principles driving equipment design. Product development and requirements. Team building. Product and service design concepts. Consumer driven design. Business planning. Marketing and market research. Intellectual property. Pricing and financial strategies. Finding sources of funding.

**PHY 455: Research Project (6 Units C: PH 270)**

**Learning Outcomes**

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

1. design and or conduct a research work on the basis of some physical laws or principles;
2. write scientific reports;
3. present and depend on a scientific research work.

**Course Contents**

The course offers students the opportunity to do research in contemporary physics under the supervision of a staff. A detailed report on the research is to be presented and depended by the student when the project is completed.

**Minimum Academic Standards**

None

**LMU-PHY 401: Satellite Communication (2 Units E: LH 30)**

**Senate Approved Relevance**

The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to relevance in driving the much-needed food security in Nigeria is Landmark University's vision and mission. Consequently, the relevance of Physics in sustainable Agriculture is vital. Therefore, this course is expected to promote self-discovery and self-actualization of the endowed potentials in agriculture, communication and technology among the students.

**Overview**

Satellite communication is a course that focuses on the principles and applications of satellite communication systems. It covers the history of satellites, types of satellite communication systems, the different types of satellites used in these systems, fundamentals of orbital mechanics, satellite orbits and positioning, satellite subsystems, analysis of communication links, access techniques, satellite networks, and applications of satellite communication such as in broadcasting, mobile communication, remote sensing, scientific research, and navigation.

Satellite Communication should provide students with a solid foundation in the principles and applications of satellite communication systems, which are essential for a wide range of fields, including telecommunications, remote sensing, and scientific research.

**Objectives**

The objectives of this course are to:

1. describe satellite communication;
2. illustrate the different satellite orbits;
3. describe the different segments of satellite communication;
4. identify the effects of the space environment on satellites, such as effects of solar activity;
5. identify the sources of errors in satellite communication.

**Learning Outcomes**

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

1. describe the three (3) segments for the successful operation of satellites;
2. list at least three (3) effects of space environment on satellites;
3. state two (2) effects of the propagation medium on satellite signal;
4. name at least one (1) means of reducing error in satellite communication;
5. describe the four (4) different satellite orbits;
6. describe the working mechanism of the Global Positioning System (GPS).

**Course Contents**

Introduction, brief history and overview of satellite communications. Satellite orbits. Satellite configurations. Satellite launching and launch vehicles. Space environment. Satellite bus subsystem. Types of propagation effects. Impacts of propagation effects on satellite communication links. Propagation path loss. Propagation models. Sources of error in satellite communication. VSAT systems, LEOs and non-geostationary

satellite systems. DBS TV and radio. Satellite navigation – Global Navigation Satellite Systems (GNSS): GPS. GLONASS. BEIDOU. Some regional satellite navigation systems.

**Minimum Academic Standard**
None

## LMU-PHY 402: Wireless and Mobile Communications (2 Units E: LH 30)

**Senate Approved Relevance**
The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to relevance in driving the much-needed food security in Nigeria is Landmark University's vision and mission. Consequently, the relevance of Physics in sustainable Agriculture is vital. Therefore, this course should to promote self-discovery and self-actualization of the endowed potentials in agriculture, communication and technology among the students.

**Overview**
Wireless and Mobile communications is a course that focuses on the principles and applications of wireless communication systems. It covers the historical evolution of wireless communication, wireless communication standards, and technologies, wireless LANs, and ad hoc networks, mobility management, radio propagation and channel models, and multiple access techniques.

Wireless and Mobile Communications would provide students with a solid foundation in the principles and applications of wireless communication systems, which are essential for a wide range of fields, including telecommunications, mobile computing, and sensor networks.

**Objectives**
The objectives of this course are to:
1. describe the principles of wireless and mobile communications;
2. demonstrate the understanding of propagation pathloss, fading, and Doppler effect;
3. recognize the unlimited opportunities and international advancement that wireless/radio communication engenders;
4. develop a well-grounded knowledge of the basics and processes in wireless/mobile communication;
5. describe the second and third Generation mobile communication systems.

**Learning Outcomes**
At the end of this course, students should be able to:
1. describe the history and trend of wireless and mobile communications;
2. sketch the basic layout of wireless communication system;
3. describe four (4) different components of wireless communication systems;
4. describe the mechanism for successful paging, cordless, and cellular systems;

5. explain the challenges of at least one (1) of the following: path loss, multipath, and Doppler effect in radio propagation;
6. list one (1) successive improvements from one generation of cellular system to another.

**Course Contents**
Evolution of mobile radio communications. Examples of mobile radio systems: radio paging, cordless telephone, cellular radio. Trends in cellular radio and personal communications. A basic cellular system: Frequency reuse. Roaming. Hand-off strategies. Co-channel interference and reduction. Traffic and grade of service, system capacity, improving capacity of cellular system. Propagation path loss. Multipath propagation problem, fading and modeling (Rayleigh, Rician, and Gaussian). Doppler effect. Field strength prediction models. Adjacent channel interference. Near-far problem. Standards and overview of analogue and digital cellular systems: AMPS, TACS, GSM, CT2, PCN, DECT, PHS. Frequency management and channel assignment. Bandwidth consideration. Equalization. Modulating techniques. Multiple access techniques. GSM: Architecture, elements, and standard interfaces. FDMA/TDMA structure. Speech and channel coding. Time slots and burst. Signalling. Hands-off; DCS1800; GPRS; data services over GSM. Third Generation Wireless Standard convergence: UMTS, IMT-2000, CDMA2000, W-CDMA, UWC-136. Network layer standards. Paging services and technologies. Short Message Services. Call processing: Signalling; Roaming and mobility management; Route optimization; Wireless Intelligent Networking; Databases; Protocols: Security and billing issues.

**LMU-PHY 403: Introduction to Space Science (2 Units E: LH 30)**

**Senate Approved Relevance**
The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to a role in driving the much-needed food security in Nigeria is the quest for Landmark University's vision and mission. Therefore, this course is expected to promote the actualization of the endowed potentials in agriculture, communication and technology among the students, and serve as a foundation for advanced studies in space science and astronomy.

**Overview**
This course would introduce students to the history of space exploration, the different branches of space science, and the present status of space science research; then an overview of the solar system including its structure and composition, properties and characteristics of the Sun, the planets, and other celestial bodies. Students would be introduce to the concept of space weather and its effect on the Earth and other planets, as well as its effect on satellite communication, navigation, remote sensing, etc.

Students would also be introduced to the study of the Universe, covering the properties and behavior of stars, galaxies, and other celestial objects. Hence, the course would provide students with a solid foundation in the principles and

applications of space science, which would be essential for further interests in wide range of field such as space exploration, astronomy, earth science, and engineering.

**Objectives**
The objectives of this course are to:
1. describe the basics and forms of solar activity;
2. outline the structure and dynamics of the Earth's magnetosphere;
3. identify and explaining the methods of observations in astronomy;
4. describe the interaction between the Earth's magnetic field and the solar wind;
5. assess the ethical implications of space exploration and research.

**Learning Outcomes**
At the end of this course, students should be able to:
1. explain the concept of solar activity and its four (4) different forms;
2. define at least three (3) terminologies used in space studies;
3. illustrate with diagram, the structure of the Earth's magnetosphere;
4. state the function of the magnetosphere.;
5. explain the evolution of the universe;
6. describe at least two (2) methods of observations in astronomy**.**

**Course Contents**
Definition of Solar Activity. History of Solar observations. Solar activity and its effects. Magnetic field of the Earth and other planets. Earth's magnetosphere. Interplanetary medium. Observing the magnetosphere and the interplanetary medium. Space weather. Aurora. Solar and geomagnetic storm. Introduction to astronomy. Structure and evolution of the universe: galaxies, stars and sun. Evidence of the Big Bang theory. The solar system: gravitation and the planets. Astronomical observations at all wavelengths. Cosmic rays. Basic cosmology. Hydrogen spectral lines and Doppler effect.

**Minimum Academic Standard**
None

**LMU-PHY 404: Design and Installation of Electrical & ICT Equipment (2 Units E: LH 30)**

**Senate Approved Relevance**
The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to a role in driving the much-needed food security in Nigeria is the quest for Landmark University's vision and mission. Therefore, this course is expected to promote the actualization of the endowed potentials in agriculture, communication and technology among the students, and serve as a foundation for advanced studies in space science and astronomy.

**Overview**
This is a course that covers the principles and applications of electrical and information and communication technology (ICT) systems. It covers a wide range of topics related

to the design and installation of electrical and ICT equipment, such as electrical wiring and safety considerations, electrical codes and standards, electrical load calculation, electrical distribution, ICT infrastructure design, telecommunications networks.

The course would also touch on the principles of project management, testing and commissioning of electrical and ICT systems. Therefore, the course will provide students with industrial knowledge and foundational principles and applications of electrical and ICT systems, which are essential for a wide range of fields, including construction, engineering, and information technology.

**Objectives**

The objectives of this course are to:

1. prepare the students for skills in electrical wiring;
2. illustrate the principles of load calculation and electrical energy distribution;
3. review the design of information and communication technology infrastructure;
4. outline the design and installation of telecommunications network;
5. explain the principles of testing and commissioning of electrical equipment and ICT systems.

**Learning Outcomes**

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

1. list three (3) factors to be considered in electrical wiring safety;
2. state two (2) different types of electrical wiring;
3. sketch the schematics of ICT infrastructure;
4. prepare the plan, schedule, and budget for a ICT design project;
5. list at least two (2) guidelines in testing and commissioning of electrical and ICT systems.

**Course Contents**

Introduction to electrical systems. Electrical codes, and standards. Introduction to electrical equipment; transformers, circuit breakers, and fuses. Introduction to electrical wiring, cable sizing, and types of wiring. Power distribution systems, load estimation, and power quality. Introduction to ICT systems; local area networks, wide area networks, and wireless networks. Structured cabling systems, cabling standards, and cable types. Network topology, network design, and network security. Installation and commissioning of electrical and ICT equipment. Maintenance and troubleshooting of electrical and ICT equipment. Safety regulations and standards for electrical and ICT equipment. Energy management, power factor correction, and energy-efficient lighting. Project management, site surveys, and project planning.

**Minimum Academic Standard**

Students will be exposed to the activities of the University center for systems and information services.

## LMU-PHY 405: Advanced Electronics Laboratory (1 Units E: PH 45)

### Senate Approved Relevance

The training of high-quality graduates as global leaders and solution providers equipped with skills and character leading to a role in driving the much-needed food security in Nigeria is the quest for Landmark University's vision and mission. Therefore, this course is expected to promote the actualization of the endowed potentials in agriculture, communication and technology among the students, and serve as a foundation for advanced studies in space science and astronomy.

### Overview

Advanced Electronics Laboratory is a course that builds upon the foundational knowledge of electronics and provides hands-on experience in designing, building, and testing advanced electronic circuits and systems. The course typically includes a series of laboratory experiments, where students work on individual or group projects to design and build advanced electronics circuits and systems. The experiments may involve the use of simulation software, oscilloscopes, signal generators, and other testing equipment.

Students will work on projects that require them to integrate multiple electronics concepts and apply them to real-world problems. The course also emphasizes the use of computer-aided design (CAD) tools for circuit design and simulation. Therefore, Advanced Electronics Laboratory would provide students with the practical skills and knowledge needed to work on advanced electronics projects, which are essential for a wide range of fields, including engineering, telecommunications, and electronic design.

### Objectives

The objectives of this course are to:

1. provide advanced understanding of electronic circuits;
2. develop practical skills in electronics, with experience in building, testing, and troubleshooting electronic circuits;
3. develop the knowledge of electronic testing and measurement;
4. apply theoretical knowledge to practical problems;
5. synthesize creativity and innovation in the students;
6. prepare students for further study or employment in the field of electronics;
7. demonstrate an understanding of how theoretical concepts can be applied in real-world applications.

### Learning Outcomes

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

1. design one (1) advanced electronic circuits;
2. test and troubleshoot at least one (1) advanced electronic circuits;
3. apply theoretical knowledge to solve at least one (1) practical problems and design projects in electronics;
4. analyse one (1) advanced electronic circuits;
5. evaluate the knowledge of advanced electronic principles, practical skills, and problem-solving abilities.

**Course Contents**
Design and fabrication of Integrated Circuits (ICs). Types of ICs. Digital Electronics; design of digital logic circuits. Implementation of digital logic circuits. Combinational and sequential logic circuits. Memory circuits. Programmable logic devices. Analog Electronics; analog circuits (amplifiers, filters, oscillators, and voltage regulators). Power electronic circuits (DC-DC converters, inverters, and motor drives). Implementation of communication systems. Analog and digital modulation techniques. Receiver design. Transmission line analysis. Implementation of electronic instrumentation and control systems. Sensor and actuator interfacing, signal conditioning, and feedback control.

**Minimum Academic Standard**
Standard Advanced Electronics Laboratory

**LMU-PHY 406: Applications of Geophysics (2 Units E: LH 30)**

**Senate Approved Relevance**
The course is designed to equip students with the knowledge of the applications of geophysics in agriculture, environmental hazard assessment and exploration. Acquiring the knowledge of powerful tools and techniques that will solve agricultural, environmental and natural resource exploration problems answers the mission and vision of the Landmark University of harnessing the hidden resources of the Earth and raising a generation of solution providers through a qualitative and life-applicable training system that focuses on value and creative knowledge.

**Overview**
This course is designed to make students adequately understand the applications of geophysical methods in agriculture, natural and environmental hazards assessments, groundwater exploration, solid mineral exploration and hydrocarbon prospecting.

Agricultural geophysics is an emerging discipline that involves non-invasive geophysical techniques for obtaining valuable soil surface and near-surface information. The three geophysical methods predominantly used for agricultural purposes are resistivity, electromagnetic induction, and ground-penetrating radar. In addition to these predominantly used methods, this course provides shorter descriptions of three additional geophysical methods: magnetometry (passive), self-potential (passive), and seismic (active), all of which have the potential for substantial future use in agriculture, but at present are being employed sparingly or not at all for agricultural purposes. This course also discusses the applications of remote sensing and GIS in agricultural surveys.

This course will provide students with valuable knowledge and geophysical skills that can be useful in understanding and solving environmental problems. It will help students understand natural and environmental hazards such as earthquakes, tsunamis, landslides, volcanic eruptions, and soil and water contamination. By

understanding these hazards and environmental risks, one can better prepare for, monitor and mitigate their impact.

This course will also provide the theoretical and practical knowledge of exploring solid minerals in the Earth using geophysical tools. Geophysical methods exploit the differences in the physical properties of subsurface materials, such as density, magnetic susceptibility, seismic velocity and density, to identify areas with high potential for mineral deposits, which can be used to guide drilling and exploration activities, reducing the cost and risk of mineral exploration.

Groundwater is an indispensable resource for sustenance of living organisms on Earth. One of the purposes of this course is to prepare students for solving groundwater problems and for locating valuable hydrocarbon accumulation in the Earth's subsurface using geophysical tools. This course considers geophysical methods that are used extensively in groundwater investigation and petroleum exploration with the primary goal of adding another dimension to geological knowledge. The methods include electrical resistivity, electromagnetic, gravity, magnetic and seismic methods. Geophysical investigation is a type of geological investigation that employs equipment to record changes in the physical properties of rocks in the subsurface. It thus entails the application of principles of geophysics to the deduction of rock types, geological configurations and reservoir characteristics for identification of the potential areas of groundwater and hydrocarbon resource accumulations.

**Objectives**

The objectives of this course are to:

1. describe the concept of geophysical methods;
2. relate the concept of geophysical methods to agricultural science;
3. describe the measurement of soil electrical conductivity;
4. explain the potentially significant future use of magnetic, gravimetric, self-potential and seismic methods in agriculture.
5. describe the agricultural remote sensing;
6. review the measurement, reduction and interpretation of common geophysical methods in solid mineral prospecting, groundwater investigations and hydrocarbon exploration;
7. state the strengths and weaknesses of each geophysical methods;
8. list environmental challenges and the importance of Environmental Geophysics;
9. describe the application of geophysical methods in environmental studies such as detection of water seepage and contaminations;
10. outline the use of remote sensing for environmental monitoring and change detection; and
11. describe case histories on the application of geophysics in agriculture, mineral prospecting and environmental hazard assessment.

**Learning Outcomes**

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

1. list at least two (2) geophysical applications in agriculture;

2. explain the principles of resistivity, electromagnetic induction and GPR methods in agricultural geophysics;
3. illustrate the measurement procedure of soil electrical conductivity;
4. describe two (2) applications of remote sensing for agriculture;
5. state two (2) main geological and geophysical characteristics of some selected environmental problems; and
6. state at least one (1) importance of each of the geophysical methods in solving the above-mentioned environmental problems and describe how the methods can be applied.

**Course Contents**
Introduction to geophysical methods. Geophysics for Agriculture. Ground-Penetrating Radar (GPR), remote sensing and GIS applications in agriculture. Magnetometry, gravity, self-potential, and seismic potential use in agriculture; case histories. Application of Geophysics in Solid Mineral Exploration. Resistivity Depth Sounding. Resistivity Tomography. Very low-frequency electromagnetic survey. Frequency-domain electromagnetic survey. Time-domain electromagnetic survey. Magnetotelluric Survey for mineral exploration. Case histories. Groundwater and hydrocarbon Geophysical Investigations; case histories. Geophysics for Environmental Hazard Assessment. GPR and potential field methods in environmental studies. Application of satellite remote sensing in monitoring environmental changes and for risk detection; case studies.

**Minimum Academic Standard**
None

**LMU-PHY 407: Geophysical Data Analysis and Interpretation with Software Applications (2 Units E: LH 30)**

**Senate Approved Relevance**
The use of software applications for geophysical data analysis and interpretation has become increasingly important in the 21st century. In order to build solution providers in our highly challenging world today, there is need to equip students with valuable skills and knowledge that are of high demand in a variety of industries. Software applications can help to visualize and analyse large amounts of data, enabling more accurate and efficient interpretation of geophysical data. Hence, this course is designed to build solution providers in line with Landmark's vision and mission.

**Overview**
Geophysical data analysis and interpretation is the process of extracting meaningful information from data collected through geophysical methods. The geophysical data are processed and analysed using mathematical and statistical tools embedded in geophysical software to develop models of the subsurface. Geophysical data analysis and interpretation is a critical component of subsurface exploration and is essential for understanding the Earth's physical properties.

This course will give students practical knowledge of geophysical data analysis and interpretation skills that can help to identify and characterize subsurface geological structures, natural resource deposits, natural hazards and environmental contamination, making the students potential assets for natural resource exploration and management industries. This course covers the analysis and interpretation of magnetic, gravity, electromagnetic, electrical resistivity, radiometric and seismic methods of geophysics.

**Objectives**

The objectives of the course are to:

1. describe the common geophysical software;
2. recall the theory behind each geophysical technique;
3. illustrate the use of each computer geophysical application software;
4. apply each computer application to real geophysical data;
5. infer information from data obtained with the different types of geophysical methods.

**Learning Outcomes**

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

1. use at least one (1) computer geophysical software application for processing and analyzing geophysical data;
2. interpret one (1) results derived from the computer application software;
3. evaluate data obtained from the gravity survey methods; and
4. outline at least two (2) geological implications of the result.

**Course Contents**

Magnetic Data: Qualitative and Quantitative Analyses of Magnetic Data. Forward and Inverse modelling. Interpretation pitfalls. Gravity Data: Qualitative and Quantitative Analyses of Gravity Data. Forward and Inverse modelling. Interpretation pitfalls. Electromagnetic Data: Profile interpretation, Gridding of EM data; Pseudo-section Interpretation; Depth and Skin Depth estimations. Interpretation pitfalls. Electrical Resistivity Data: Resistivity Depth Sounding; Resistivity Profiling and Mapping; 2-D Tomography; Interpretation pitfalls. Practical applications of some relevant software to the above topics. Radiometric Data: introduction to radiometric methods; Ratios of Radiometric Data; Ternary Radiometric Map; Radiogenic Heat Estimation; Interpretation pitfalls. Seismic Data: basic earthquake or exploration data analysis and interpretation.

**LMU-TMC 411 Total Man Concept VII (1 Unit C: LH 15)**

**Senate Approved Relevance**

In line with the University's goal of raising solution providers, LMU-TMC411 is designed to inculcate the values that makes a winner into every student that passes through the University. These include the discovery of self, the cultivation of a life-style of faith which is required by anyone who desires to level mountains and provide solutions for

his or her world. Since faith is required to birth all the solutions that our world currently desires, the relevance of this course is therefore established.

**Overview**
The aim of this Course is to equip students with spiritual nuggets for impactful living as they prepare for life outside the University context. It presents the essential biblical wisdom for a life of exploits. Students on this course will be able to explore and apply the paths flagged in the various presentations in sharpening and articulating their personal visions and goals.

Furthermore, understanding the place of preparation and the clarity of purpose in each student will embolden them to face challenges while the various biblical wisdom acts such as preparation, skill acquisition and commitment will ensure the achievement of success.

**Objectives**
The objectives of this course are to:
1. define faith;
2. differentiate between faith and belief;
3. list the power of ideas;
4. state biblical success principles;
5. describe the power of skill;
6. list the benefits of consecration;
7. describe the power of commitment.

**Learning Outcomes**
At the end of this course, students should be able to:
1. define faith;
2. differentiate between faith and belief;
3. state at least two (2) benefits of ideas;
4. state at least four (4) biblical success principles;
5. describe the power of skill;
6. state at least two (2) benefits of consecration;
7. describe the power of commitment.

**Course Contents**
Understanding the place of Preparation. The Foundation of Faith. Understanding the power of Ideas. Understanding Biblical Success Principles. Understanding the power of purpose. Practical steps for self-discovery. The Power of Attitude. The Power of Passion. Health Talk. Understanding the place of Commitment. The Place of Consecration. The power of skill.

**Minimum Academic Standards**
None

**LMU-TMC 421: Total Man Concept VIII (1 Unit C: LH 15)**

**Senate Approved Relevance**
The training of the God-fearing and value driven individuals are entrenched in the vision and mission of Landmark University. However, for the graduates from Landmark University to effectively function in the society, the proper understanding of marriage and the role of the family in national and global development is very important. Acquiring the wisdom for parenting as well as family financial management are also crucial. Hence, the reason for the development of this course.

**Overview**
The Total Man Concept was originally designed for the complete development of man and the importance of marriage in the life of a man cannot be overemphasized. In order to help students to avoid the pitfall of wrong marriage which often lead to divorce and several other emotional issues, this course is built with important content which helps the students to understand the creation and the nature of marriage.

The course begins with a cross-examination of issues in Marriage and Family Life. This is followed by the establishment of a proper understanding of the marriage covenant and how to adequately prepare for marriage so as to avoid lifetime regret. Issues in intimacy such as financial issues, temperamental differences and challenges with the hybridization of two people from culturally diverse background will be extensively discussed. The responsibilities of a Christian family to the society and their importance to national development will also be explained. While presenting new development in the structure of the family, biblical examples that can be used as models will be analyzed.

**Objectives**
The objectives of this course are to:
1. identify various issues in marriage and family life;
2. define the Christian marriage;
3. enumerate the role of the family in national and global development;
4. identify family financial management methods;
5. describe the new family structure;
6. state biblical models of the family context.

**Learning Outcomes**
At the end of this course, students should be able to:
1. outline at least four (4) common issues in marriage and family life;
2. describe the Christian Marriage;
3. state at least three (3) roles of family in national and global development;
4. describe family finance management;
5. describe the new family structure;
6. state at least five (5) biblical family models;

**Course Contents**
Issues in Marriage and Family Life. Understanding the Marriage Covenant. Preparing for marriage: Issues in intimacy. Understanding family responsibilities. Christian

Marriage: A triune relationship. Role of family in national, social and global development. New Dynamics in the structure of the family. Parenting Issues and practices. Managing family finances. God's mandate for the family. Biblical models of the family context.

**Minimum Academic Standards**
None

**Staffing**

**Academic Staff**
The guidelines on academic staff/student ratio of 1:20 for Science Programmes shall apply. To start any programme in Science, there should be a minimum of six academic staff. There is need to have a reasonable number of staff with PhD degrees accounting for at least 70% of the total number and having adequate teaching experience for every programme in the Discipline.

**Administrative Support Staff**
The services of the administrative support staff are indispensable in the proper administration of the Department. It is important to recruit very competent, computer literate senior staff.

**Technical Support Personnel**
The services of technical support staff, which are indispensable in the proper running of laboratories are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

**Classrooms, Laboratories, Workshops and Office Space** The NUC recommends the following physical space requirements:

| **Description** | | **Size $m^2$** |
|---|---|---|
| Professor's Office | - | 18.50 |
| Head of Department's Office | - | 18.50 |
| Tutorial Teaching Staff's Office | - | 13.50 |
| Other Teaching Staff Space | - | 7.00 |
| Technical Staff Space | - | 7.00 |
| Secretarial Space | - | 7.00 |
| Research Laboratory | - | 16.50 |
| Seminar Space/per student | - | 1.85 |
| Laboratory Space per FTE | - | 7.50 |
| Conference Room | - | 37.0 |

**Library**

The University Central Library should be well stocked with current journals, textbooks, and reference materials for the use of staff and students. The library should be linked with internet for information sourcing. There should be subscription to at least two relevant database.

**Equipment**

| S/N | Description |
|---|---|
| 1 | Measuring cylinder 250 ml (glass + plastic) |
| 2 | Measuring cylinder 50ml |
| 3 | Measuring cylinder 25ml |
| 4 | Measuring cylinder glass (0 – 1000 ml) |
| 5 | Harris ripple tank |
| 6 | Beaker (50ml, 250 cc) |
| 7 | Glass beaker (4,000ml) |
| 8 | Flat bottom flask |
| 9 | Stopwatch |
| 10 | Stop clock |
| 11 | Weight (1Kg, 2Kg, 5Kg) |
| 12 | Weight (500g, 200g, 100g, 50g, 20g, 10g, 5g) |
| 13 | Weighing balance digital |
| 14 | Weighing balance Metter |
| 15 | Air blower |
| 16 | Pulleys |
| 17 | Calorimeter |
| 18 | T Square |
| 19 | Wet cells |
| 20 | Tripod stand |
| 21 | Hydrometer |
| 22 | Spring balance |
| 23 | U Tube |
| 24 | Glass funnel |
| 25 | Conventional air apparatus |
| 26 | Rectangular glass block |
| 27 | Convex lens |
| 28 | Glass prism |
| 29 | Bar and gauge |

| | |
|---|---|
| 30 | Telescope |
| 31 | Linear expansion apparatus |
| 32 | Bulb hide |
| 33 | Mercury metal (800g) |
| 34 | Resistor Box (100Ω, 1000Ω) |
| 35 | Resistor (0.6Ω) |
| 36 | Turning forks |
| 37 | Standard resistors (1, 2, 5, 10, 20, 50, 100 Ω etc.) |
| 38 | Rheostat |
| 39 | Decade resistance box |
| 40 | Oscilloscope (Double beam) |
| 41 | Signal generator |
| 42 | Spectrometer |
| 43 | Transformer |
| 44 | Sodium lamp |
| 45 | Mercury lamp |
| 46 | Extensometer |
| 47 | Density bottle |
| 48 | Wooden board |
| 49 | Meter bridge |
| 50 | One way key |
| 51 | Boyles law apparatus |
| 52 | Voltmeter |
| 53 | Ammeter |
| 54 | Galvanometer |
| 55 | Universal indicator |
| 56 | Relays |
| 57 | Burette |
| 58 | Meter rule |
| 59 | Table lamp |
| 60 | Optical bench |
| 61 | Micrometre screw gauge |
| 62 | Vernier calliper |
| 63 | Filter paper |
| 64 | Litmus paper |
| 65 | Standing fan |
| 66 | Thermometer (Mercury in glass, alcohol in glass) |

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|---|---|
| 67 | Slotted masses (1, 2, 5, 10 Kg) |
| 68 | Slotted masses (5, 10, 20, 100, 200, 500g) |
| 69 | Micro amplifier |
| 70 | Pyrometer |
| 71 | Micrometre screw gauge |
| 72 | Decade capacitor |
| 73 | Standard capacitors |
| 74 | Long Glass tubes |
| 75 | High Current DC power supply |
| 76 | Turning forks |
| 77 | Plastic tubes |
| 78 | Aluminium sheets |
| 79 | Tetrameter |
| 80 | Connecting cable |
| 81 | Metal electrode |
| 82 | Interface cable |
| 83 | Metallic-bucket |
| 84 | Drawing board |
| 85 | Force board |
| 86 | Young modulus apparatus |
| 87 | Meter rule |
| 88 | Optical bench (Wooden) |
| 89 | Ray box |
| 90 | Avometer (Analogue) |
| 91 | Copper sheets |
| 92 | Discharge lamp |
| 93 | Meldes apparatus |
| 94 | Soldering wire |
| 95 | Battery charger |
| 96 | Burette (50cc) |
| 97 | Lens holder (Wooden) |
| 98 | Spiral spring |
| 99 | Plane mirror |
| 100 | Microscope slide |
| 101 | Sonometer |
| 102 | Soldering iron |
| 103 | Simple Microscope |

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|---|---|
| 104 | Travelling microscope |
| 105 | Specific gravity bottle |
| 106 | Barometer |
| 107 | Hydrometer |
| 108 | Diffraction grating |
| 109 | Sodium lamp |
| 110 | Table lamp |
| 111 | AC Ammeter /voltmeter |
| 112 | Ammeter (Double Range) |
| 113 | Milliammeter (Double Range) |
| 114 | Beaker (Pyrex 500cc) |
| 115 | Retort Stand (Complete) |
| 116 | Millivolt meter |
| 117 | Chemical Balance |
| 118 | Galvanometer |
| 119 | One-Way-Key |
| 120 | Jockey |
| 121 | Wheatstone Bridge |
| 122 | Electrolyte Capacitor |
| 123 | P – N Junction Diode |
| 124 | Standard Electrodes |
| 125 | Bar Magnet |
| 126 | Decade Capacitance Box |
| 127 | High Vacuum Intonation (Edwards) |
| 128 | Projector |
| 129 | Science Workshop 750 Interface (USB) |
| 130 | Model CI 75gg with accessories |
| 131 | Vacuum Pump |
| 132 | Spectrum Analyzer |
| 133 | Model 80 801OB |
| 134 | Hydro - electrical Power Station Apparatus |
| 135 | Volume determination of a solid Kit No.042 |
| 136 | Air as a thermal insulator Kit No.045 |
| 137 | Steam Canon KL No. 017 |
| 138 | Osmotic pressure Kit No. 084 |
| 139 | Conductivity of Solution with Kit No.006 |
| 140 | Conductivity of Solid Kit No.005 |

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|---|---|
| 141 | Visualizing Hydrostatic pressure Kit No.063 |
| 142 | Marioff's column and flow rate devices Kit No.064 |
| 143 | Liquid at different sensitivities Kit No.048 |
| 144 | Conductivity in Liquids Kit Nos. 036 & 037 |
| 145 | Porosity of Bricks Kit No. 072 |
| 146 | Chemical activation of an electric motor Kit No. 032 |
| 147 | Floating Bodies in Liquids of different densities Kit No.049 |
| 148 | Thermal expansion of a bimetallic strip Kit No. 040 |
| 149 | Prism Kit 075+076+077 |
| 150 | Experiments in electromagnetism Kit Nos. 003 & 007 |
| 151 | Electric Generator Kit No.018 |
| 152 | Steady hand Kit No. 038 |
| 153 | The cave of Dogs Kit No.079 |
| 154 | Two –ball pendulum Kit No.030 |
| 155 | Melting a metal in Hot Water Bismuth Alloy Kit No.046 |
| 156 | Flow rate of Liquids with different viscosities Kit No.055 |
| 157 | Maxwell's Pendulum Kit No.031 |
| 158 | Air Occupies Space Kit No.041 |
| 159 | Intermolecular Spaces in Liquids Kit No.069 |
| 160 | Inter atomic forces in metals Kit No. 068 |
| 161 | Conductivity of Solutions and Solids Kit No.004 |
| 162 | Heating Water with a Concave Mirror Kit No.078 |
| 163 | Electromagnetism: Oested's effect Kit |
| 164 | Double Slit |
| 165 | Grating |
| 166 | Convex Mirror |
| 167 | Plane Mirror |
| 168 | Electric field meter |
| 169 | Altitude meter |
| 170 | Hot Plate |
| 171 | Digital Stop Clock |
| 172 | Compound Pendulum |
| 173 | Optical Bench (Metallic Screen& Lens Holder) |
| 174 | Avometer (Analogue) |
| 175 | Avometer (Digital) |

| | |
|---|---|
| 176 | Mercury Lamp |
| 177 | Box of Aluminium Foil |
| 178 | Handling Tong |
| 179 | Radioactive Sources |
| 180 | Radioactive Cabinet |
| 181 | EMS Radiation Meter |
| 182 | Heat Index Meter |
| 183 | New Temperature Coefficient Apparatus |
| 184 | Distiller |
| 185 | Ammeter (Variable range AC/DC or DC)) |
| 186 | Angle Table Lamp |
| 187 | Abingdon Sound Wave Kit |
| 188 | Air Cell |
| 189 | Adaptor WPA (Shunts) |
| 190 | A/C Potentiometer (Wide Range) |
| 191 | Tetrameter SAS 1000 |
| 192 | Adaptor WPA (Shunts) |
| 193 | A/C Potentiometer (Wide Range) |
| 194 | Audio Amplifier |
| 195 | A/C – DC Lamp (S  N) |
| 196 | AC/DC Converter Trainer (AD 4101) |
| 197 | AC/DC Power Supply Baku (BK 1502 DD) |
| 198 | Analogue dial (Various turns) |
| 199 | Aluminium Solder (16 SWG) |
| 200 | AM/DSB Transmitter (KL 93061) |
| 201 | AM Radio Transmitter |
| 202 | Battery Charger |
| 203 | Basic Spark Source |
| 204 | Bunsen Burner |
| 205 | Bi-convex Lens (Various focal length) |
| 206 | Bi-concave Lens (Various focal length) |
| 207 | Beaker Pyrex (Various ml) |
| 208 | Beaker Plastic (250 ml) |
| 209 | Beaker CSN (Various ml) |
| 210 | Bar Magnet |
| 211 | Blade Connector |
| 212 | Battery Clips |

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|---|---|
| 213 | Cathode ray tube (Unilab) |
| 214 | Ballistic Module 099624 |
| 215 | Bench Power Supply (Philip Harris G85458) |
| 216 | Copper Wire |
| 217 | Constantan Wire |
| 218 | Constantan Alloy |
| 219 | Camera Lens |
| 220 | Camera (Simple type) |
| 221 | Camera (For Oscilloscope) |
| 222 | Capacitance Box (Type C500) |
| 223 | Capacitance substitution box 012308 |
| 224 | Cathode ray Oscilloscope 099622 |
| 225 | Convex Mirror (Various Focal Length) |
| 226 | Concave Mirror (Various Focal Length) |
| 227 | Coiled Core |
| 228 | Cable (3 Core) |
| 229 | Cable, (Individually screened 4 core) |
| 230 | " (Screened, twin) |
| 231 | " ( Low noise) |
| 232 | " (Air spaced coax) |
| 233 | " (300 Ohms twin feeder) |
| 234 | Capacitor, electrolyte (Various values) |
| 235 | Cable Polystyrene (Various values) |
| 236 | " Silvered mica (Various values) |
| 237 | " Ceramic (Various values) |
| 238 | " Paper (Various values) |
| 239 | " M D C (Various values) |
| 240 | " Trimmers Compression |
| 241 | " Trimmers |
| 242 | Circuit Breaker (Various amps) |
| 243 | Capacitor Suppression |
| 244 | Choke Suppression (Various values) |
| 245 | CMOS Logic checker |
| 246 | Crystal Sockets |
| 247 | Crimp connectors (Various types and sizes) |
| 248 | Communing block |
| 249 | Communing connectors |

| | |
|---|---|
| 250 | Clock timer IC |
| 251 | Condenser microphone |
| 252 | Dart Board Set |
| 253 | Discharge lamp holder |
| 254 | Discharge lamp transformer |
| 255 | Discharge lamp, sodium |
| 256 | Discharge lamp, cadmium |
| 257 | Discharge lamp, mercury |
| 258 | Discharge lamp, Helium |
| 259 | Discharge lamp, Neon |
| 260 | Digital multimeter |
| 261 | Diode (Various types) |
| 262 | Digital dial (10 turns) |
| 263 | Differential amplifier 1445 |
| 264 | Diffraction Grating |
| 265 | Digital Clock module |
| 266 | D to A converter IC ZN 425 E |
| 267 | Darlington drivers |
| 268 | 4-Decade counter driver |
| 269 | Dual pin recorder |
| 270 | D C Power Supply (ST 4078) |
| 271 | Electric timer 6 – 12V AC |
| 272 | Etch resist ink pen |
| 273 | Electro conductive paint |
| 274 | Electronic alternator IC |
| 275 | Electricity LAB (NV6000) |
| 276 | Electronics Kit (Basic Elect. Expt PK101) |
| 277 | e/m Apparatus (SE 9638) |
| 278 | Frequency counter |
| 279 | Fuses (Various values and sizes) |
| 280 | Fresnel Biprism |
| 281 | Ferrite beads |
| 282 | F E T input OP amp DIL |
| 283 | " (Various types) |
| 284 | Function Generator |
| 285 | Fibre Optic Kit (Fok 721) |
| 286 | FM Transmitter (KL 93063) |

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|---|---|
| 287 | Geissher's tube Helium |
| 288 | " " Argon |
| 289 | " " Hydrogen |
| 290 | " " Nitrogen |
| 291 | " " Mercury |
| 292 | " " Oxygen |
| 293 | " " Neon |
| 294 | " " Unknown |
| 295 | " " Carbon Dioxide |
| 296 | " " Holden |
| 297 | Galvanometer |
| 298 | " Electronic |
| 299 | Manganin wire |
| 300 | Mobile Phone Trainer |
| 301 | Nanovolt pre-amplifier |
| 302 | Neon indicator 250V (Various colours) |
| 303 | Nichrome wire |
| 304 | Solar Cells |
| 305 | LED Lights |
| 306 | Waveform generator |
| 307 | Holography set |
| 308 | Interferometer |
| 309 | Physical optics kit |
| 310 | Leak rate meter |
| 311 | Photocell |
| 312 | Photodiode |
| 313 | Rectifier unit |
| 314 | T S Module 401.1 Diode characteristics |
| 315 | T S Module 401.2 DC power supply unit |
| 316 | Transmission Line Trainer (ST 2261) |
| 317 | Junction transistor common base connection |
| 318 | Junction transistor common emitter |
| 319 | Transistor Tester |
| 320 | Unijunction transistor (U J T) |
| 321 | Constant Current Source |
| 322 | Emitter Follower voltage stabilizer |
| 323 | Free-running multivibrator |

| | |
|---|---|
| 324 | Silicon controlled rectifier |
| 325 | Travelling microscope |
| 326 | Multivibrator |
| 327 | 555 Timer |
| 328 | Relay |
| 329 | Sunshine Recorder with Accessories |
| 330 | Solar Power Meter |
| 331 | Sound Level Meter |
| 332 | Advanced Spectrometer |
| 333 | Semiconductor Kit |
| 334 | Modern Tech. & Electronic Trainer System |
| 335 | Communication Training System |
| 336 | Technology & The Computer Training System |
| 337 | Analog Communication Training System |
| 338 | Digital Communication Training System |
| 339 | Optical Communication Trainer |
| 340 | Analog-Digital Signal Conversion Trainer |
| 341 | Electricity & Semiconductors Training System |
| 342 | Analog Electronics Training System |

## List of Reviewers for 70% Science CCMAS

| Title | Surname | First Name | Institution | Programme |
|---|---|---|---|---|
| Professor | AKANJI | Musbau | University of Ilorin | **Chairman**/ Biochemistry |
| Professor | MAFIANA | Chiedu | National Open University of Nigeria | **Co-Chairman** |
| Professor | OSILIKE | Micah | University of Nigeria Nsukka | Representative Nigerian Academy of Science |
| Professor | ONIYE | Sonnie | Ahmadu Bello University Zaria | Biology |
| Professor | OKIGBO | Raphael | Nnamdi Azikiwe University Awka | Botany |
| Professor | EKPO | Uwemedimo Friday | Federal University of Agriculture Abeokuta | Zoology |
| Professor | ILORI | Matthew Olusoji | University of Lagos | Biotechnology |

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|---|---|---|---|---|
| Professor | ADEJUMO | Timothy Olubisi | Adekunle Ajasin University, AkungbaAkoko | Brewing Science |
| Professor | ODOKUMA | Lucky | University of Port Harcourt | Microbiology |
| Professor | ALIYU | Adetutu | Nigeria Defence Academy | Chemistry |
| Professor | LAWAL | Abdulazeez | Fountain University Osogbo | Industrial Chemistry |
| Professor | YAKASSAI | Ibrahim Adamu | Bayero University Kano | Medicinal Chemistry |
| Professor | OSUJI | Leo Chigbu | University of Port Harcourt | Petroleum Chemistry |
| Professor | OLAYINKA | Adewoye | Ladoke Akintola University of Technology Ogbomoso | Environmental Management & Toxicology |
| Professor | OJO | Sola | Federal University Oye-Ekiti | Geology |
| Professor | ISAAC | Aigbedion | Ambrose Alli University, Ekpoma | Geophysics |
| Professor | IBRAHEEM | Mohammed | University of Ilorin | Mathematics |
| Professor | BAKARI | Harun | University of Maiduguri | Statistics |
| Professor | ALAO | Felix | Federal University of Technology Akure | Industrial Mathematics |
| Professor | UGWUMBA | Adiaha Alda | University of Ibadan | Marine Science |
| Professor | AMA- ABASI | Daniel | University of Calabar | Maritime Science |
| Professor | MATAZU | Mansur Bako | Federal University Dutsina-Ma | Meteorology |
| Professor | DARMA | Tijjani Hassan | Bayero University Kano | Physics |
| Professor | EKPUNOBI | Azubike Joshua | Nnamdi Azikiwe University Awka | Industrial Physics |
| Professor | AWOJOYOGBE | Bamidele O. | Federal University of Technology Minna | Medical Physics |
| Professor | MBOTO | Clement Obi | University of calabar | Science Laboratory Technology |
| Professor | ARZAI | Auwalu Halliru | Bayero University Kano | Forensic Science |

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|---|---|---|---|---|
| Professor | TIJJANI | Auwal Musa | Abubakar Tafawa Balewa University Bauchi | Physics with Electronics |

## List of NUC Representatives for the 70% Science CCMAS

| Title | Surname | First Name | Programme |
|---|---|---|---|
| Mrs. | SAMBO | Sa'adiya | **Discipline Representative**/ Biology & Geology |
| Mr. | EBEGUNA | Ikechukwu Paul | Biochemistry |
| Miss. | ETIM | Okoho | Botany |
| Miss. | SANI | Zainab Onayi | Zoology & Chemistry |
| Dr. | IRENE | Angela | Biotechnology |
| Mrs. | DADA | Olayemi | Brewing Science & Technology and Industrial Chemistry |
| Mrs. | ODAUDU | Oluwabukunmi | Microbiology |
| Mr. | MOHAMMED | Abubakar Tanko | Medicinal Chemistry |
| Mr. | KOLAWOLE | Banji | Petroleum Chemistry and Forensic Science |
| Miss. | ODUDU | Gloria | Environmental Management & Toxicology |
| Mr. | ONI | Abimbola | Applied Geophysics |
| Mr. | MOHAMMED | Abubakar S. | Mathematics |
| Mr . | TOBRISE | Peter | Meteorology & Statistics |
| Mr. | OCHALA | Solomon | Industrial Mathematics |
| Mrs. | SULE | Olufunke | Marine Science |
| Dr. | AUDU | Bridget | Maritime Science |
| Mr. | BAKO | Audu | Physics |
| Mr. | OKAFOR | Ikechukwu David | Industrial Physics |
| Mr. | DAUDA | Nehemiah | Medical Physics |
| Miss. | EKWUEME | Amuche | Science Laboratory Technology |
| Mr. | ADELEKE | Adeyemi | Physics with Electronics |

## List of Contributors to the institutional 30% CCMAS for BSc Physics Programme

| Title | Surname | First Name | Middle Name | |
|---|---|---|---|---|
| Professor | ADEBESIN | Babatunde | Olufemi | Dean, School of Postgraduate Studies |
| Dr | ADEBIYI | Shola | John | Director, Academic Planning |
| Dr | IKUBANNI | Stephen | Oluwole | Ag. Head of Physical Sciences Department |
| Dr | FALADE | Sesan | Cornelius | Physics Programme Coordinator |

| | | | | |
|---|---|---|---|---|
| Mr | DOPAMU | Kehinde | Oladele | Programme Examination Officer |
| Mr | ADEBIYI | Leke | Sunday | Departmental Examination Officer |
| Mrs | ALEJOLOWO | Esther | A. | |
| Mr | OLANREWAJU | Dada | Bukola | |

## Members of the University Curriculum Committee for the Institutional 30% CCMAS

| **Title** | **Surname** | **First Name** | **Middle Name** | |
|---|---|---|---|---|
| Dr | INYINBOR | Adejumoke | Abosede | Chairman & Representative of College of Pure and Applied Sciences |
| Dr | OKUNOLA | Abiodun | A. | Representative, College of Engineering |
| Dr | RASAQ | Bamidele | | Representative, College of Business and Social Studies |
| Dr | ALORI | Elizabeth | | Representative, College of Agricultural Sciences |
| Dr | ADEBIYI | Shola | John | Director, Academic Planning |
| Mr | BABALOLA | Leke | | Secretary & Senior Assistant Registrar (Academic Planning Directorate) |