11.3 CCMAS Course Listing

YEAR ONE: FIRST SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	CHM 101	General Chemistry I	3	C	45	-	NUC
2	GET 101	Engineer in Society	1	C	15	-	NUC
3	MTH 101	Elementary Mathematics I	2	C	30	-	NUC
4	PHY 101	General Physics I	2	C	30	-	NUC
5	IMSU-MTH 103	Elementary Mathematics III (Vectors, Geometry and Dynamics)	2	C	30	-	COREN
6	IMSU-PHY 103	General Physics III	2	C	30	-	IMSU
7	IMSU-GET 105	Engineering Drawing	1	C	15	30	IMSU
8	IMSU-MTH 105	Elementary Mathematics V (Mechanics)	2	C	30	-	IMSU
9	CHM 107	General Practical Chemistry I	1	C	-	45	NUC
10	PHY 107	General Practical Physics I	1	C	-	45	NUC
11	IMSU-SGB 107	Basic Igbo	1	C	30	-	IMSU
12	GST 111	Communication in English	2	C	15	45	NUC
13	IMSU-GET 121	Workshop Practice I	1	C	15	30	IMSU
14	EEE 102	Introduction to Electrical and Electronics Engineering	2	C	30	-	NUC
	Total		**23**				

YEAR ONE: SECOND SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	CHM 102	General Chemistry II	3	C	45	-	NUC
2	GET 102	Engineering Graphics and Solid Modelling I	2	C	30	-	NUC
3	MTH 102	Elementary Mathematics II	2	C	30	-	NUC
4	PHY 102	General Physics II	2	C	30	-	NUC
5	IMSU-CSD 102	Carrier Services Development	1	C	30	-	IMSU
6	IMSU-PHY104	General Physic IV (Vibration, Waves and Optics	2	C	30	-	COREN
7	IMSU-MTH 104	Elementary Mathematics IV (Coordinate Geometry)	2	C	30	-	IMSU
8	IMSU-CHM 114	Physical Chemistry	2	C	30	-	IMSU
9	CHM 108	General Practical Chemistry II	1	C	-	45	NUC
10	PHY 108	General Practical Physics II	1	C	-	45	NUC
11	IMSU-SGB 112	Igbo Readings and Practice	1	C	30	-	IMSU
12	GST 112	Nigerian Peoples and Culture	2	C	30	-	NUC
13	IMSU-STA 112	Probability I	3	C	30	-	COREN
14	IMSU-GET 122	Workshop Practice II	1	C	15	30	IMSU
	TOTAL		**25**				
	SESSIONAL TOTAL		**48**				

YEAR TWO: FIRST SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 201	Applied Electricity I	3	C	45	-	NUC
2	IMSU-GET 203	Engineering Graphics and Solid Modeling II	3	C	45	15	COREN

3	GET 205	Fundamentals of Fluid Mechanics	3	C	45	-	NUC
4	GET 207	Applied Mechanics	3	C	45	-	NUC
5	GET 209	Engineering Mathematics I	3	C	45	-	NUC
6	GET 211	Computing and Software Engineering	3	C	30	45	NUC
7	IMSU-GET 221	Engineering Laboratory I	1	C	15	45	IMSU
8	ENT 211	Entrepreneurship and Innovation	2	C	30	-	NUC
	Total		**21**				

YEAR TWO: SECOND SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	EEE 202	Applied Electricity II	3	C	30	45	NUC
2	IMSU-GET 202	Engineering Materials	3	C	45	-	COREN
3	GET 204	Students Workshop Practice	2	C	15	45	NUC
4	GET 206	Fundamentals of Thermodynamics	3	C	45	-	NUC
5	IMSU-GET 208	Strength of Materials	3	C	45		COREN
6	GET 210	Engineering Mathematics II	3	C	45	-	NUC
7	GST 212	Philosophy, Logic and Human Existence	2	C	30	-	NUC
8	IMSU-GET 222	Engineering Laboratory II	1	C	30	45	IMSU
	TOTAL		**20**				
	SESSIONAL TOTAL		**43**				

YEAR THREE: FIRST SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 301	Engineering Mathematics III	3	C	45	-	NUC
2	GET 305	Engineering Statistics and Data Analytics	3	C	45	-	NUC
3	IMSU-EEE 305	Control System I	2	C	30	-	IMSU
4	GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-	NUC
5	IMSU-EEE 311	Circuit Theory	2	C	30	-	IMSU
6	IMSU-EEE 343	Principles of Power Systems and Electrical Machines	2	C	45	30	IMSU
7	IMSU-EEE 355	Digital, Analogue and Applied Electronics	2	C	30	30	IMSU
	Total		**17**				

YEAR THREE: SECOND SEMESTER

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 302	Engineering Mathematics IV	3	C	45	-	NUC
2	GET 304	Technical Writing & Communication	3	C	45	-	NUC
3	GET 306	Renewable Energy Systems and Technology	3	C	30	45-	NUC
4	ENT 312	Venture Creation	2	C	15	45	NUC
5	GST 312	Peace and Conflict Resolution	2	C	30	-	NUC
6	IMSU-EEE 372	Communication Principles	2	C	30	-	IMSU
7	IMSU-EEE 374	Electrical and Electronic Engineering Lab	1	C	15	45	IMSU
8	IMSU-GET 308	Engineering Economics	3	C	45	-	COREN

9	IMSU-PBL 300	Problem Based Learning I	2	C	-	90	COREN
	TOTAL		**21**				
	SESSIONAL TOTAL		**38**				

YEAR FOUR: POWER SYSTEM ENGINEERING OPTION

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	IMSU-EEE 405	Electromagnetic Fields and Waves	2	C	30	-	IMSU
2	IMSU-EEE 431	Microprocessors, Microcontrollers and Embedded Systems Design and Programming	2	C	30	-	IMSU
3	IMSU-EEE 441	Power System Engineering	2	C	30	-	IMSU
4	IMSU-EEE 445	Electrical Machines	2	C	30	15	IMSU
5	IMSU-EEE 447	Power Systems and Machine Lab	1	C	15	45	IMSU
6	IMSU-EEE 451	Power Electronics	2	C	30	-	IMSU
7	IMSU-EEE 461	Process Control, Measurement and Instrumentation	2	C	30	-	IMSU
8	IMSU-GEN 481	Computer Aided Design & Manufacturing	1	C	30	-	IMSU
9	IMSU-GEN 493	Engineering Research Method	1	C	30	-	IMSU
	TOTAL		**15**				

YEAR FOUR (SECOND SEMESTER)

SIWES Courses

S/N	Course Code	Course Title	Units	Status	Duration	Remarks
1	**GET 299**	**SIWES I: SIWEP**	**3**	**C**	**9 Weeks**	**NUC**
2	**GET 399**	**SIWES II**	**4**	**C**	**12 Weeks**	**NUC**
3	**IMSU-PBL 400**	**Problem Based Learning II**	**2**	**C**		**IMSU**
4	**GET 499**	**SIWES III: Student Industrial Work Experience Scheme**	**8**	**C**	**24 Weeks**	**NUC**
	TOTAL		**17**			
	SESSIONAL TOTAL		**32**			

YEAR FOUR: TELECOMMUNICATION ENGINEERING OPTION

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	IMSU-EEE 405	Electromagnetic Fields and Waves	2	C	30	-	IMSU
2	IMSU-EEE 431	Microprocessors, Microcontrollers and Embedded Systems Design and Programming	2	C	30	-	IMSU
3	IMSU-EEE 461	Process Control, Measurement and Instrumentation	2	C	45	-	IMSU
4	IMSU-EEE 471	Digital Systems Design with VHDL	2	C	30	45	IMSU
5	IMSU-EEE 473	Digital Signal Processing and Applications, System Modeling and Simulation	2	C	30	-	IMSU
6	IMSU-EEE 475	Digital Communication Systems	2	C	30	-	IMSU
7	IMSU-EEE 477	Telecommunication Engineering Lab	1	C	15	45	IMSU
8	IMSU-GET 481	Computer Aided Design & Manufacturing	1	C	30	-	IMSU
9	IMSU-GET 493	Engineering Research Method	1	C	30	-	IMSU

	TOTAL		**15**				

YEAR FOUR (SECOND SEMESTER)

SIWES Courses

S/N	Course Code	Course Title	Units	Status	Duration	Remarks
1	**GET 299**	**SIWES I: SIWEP**	**3**	**C**	**9 Weeks**	**NUC**
2	**GET 399**	**SIWES II**	**4**	**C**	**12 Weeks**	**NUC**
3	**IMSU-PBL 400**	**Problem Based Learning II**	**2**	**C**		**COREN**
4	**GET 499**	**SIWES III: Student Industrial Work Experience Scheme**	**8**	**C**	**24 Weeks**	**NUC**
	TOTAL		**17**			
	SESSIONAL TOTAL		**32**			

YEAR FOUR: ELECTRONIC AND COMPUTER ENGINEERING OPTION

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	IMSU-EEE 405	Electromagnetic Fields and Waves	2	C	30	-	IMSU
2	IMSU-EEE 431	Microprocessors, Microcontrollers and Embedded Systems Design and Programming.	2	C	30	-	IMSU
3	IMSU-EEE 451	Power Electronics	2	C	30	-	IMSU
4	IMSU-EEE 471	Digital Systems Design with VHDL	2	C	30	-	IMSU
5	IMSU-EEE 459	Electronic and Computer Engineering Lab	1	C	15	45	IMSU
6	IMSU-EEE 461	Process Control, Measurement and Instrumentation	2	C	45	15	IMSU
7	IMSU-EEE 473	Digital Signal Processing and Applications, System Modeling and Simulation	2	C	30	-	IMSU
8	IMSU-GET 481	Computer Aided Design & Manufacturing	1	C	30	-	IMSU
9	IMSU-GET 493	Engineering Research Method	1	C	30	-	IMSU
	TOTAL		**15**				

YEAR FOUR (SECOND SEMESTER)

SIWES Courses

S/N	Course Code	Course Title	Units	Status	Duration	Remarks
1	**GET 299**	**SIWES I: SIWEP**	**3**	**C**	**9 Weeks**	**NUC**
2	**GET 399**	**SIWES II**	**4**	**C**	**12 Weeks**	**NUC**
3	**IMSU-PBL 400**	**Problem Based Learning II**	**2**	**C**		**COREN**
4	**GET 499**	**SIWES III: Student Industrial Work Experience Scheme**	**8**	**C**	**24 Weeks**	**NUC**
	TOTAL		**17**			
	SESSIONAL TOTAL		**32**			

YEAR FIVE: FIRST SEMESTER (POWER SYSTEM ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 501	Engineering Project Management	3	C	45	-	NUC
2	IMSU-EEE 507	Electrical and Electronic Engineering Analysis	1	C	15	-	IMSU
3	IMSU-EEE 543	Power System Protections	2	C	30	-	IMSU
4	IMSU-EEE 545	Switchgear and High Voltage Engineering	2	C	30	-	IMSU
5	IMSU-EEE 551	Computer Organization and Architecture	2	C	30	-	IMSU
6	IMSU-EEE 561	Modern Control Systems and Design II	2	C	30	-	IMSU
7	IMSU-CSD 401	Career Services Development	1	C	15	-	IMSU
8	EEE 593	Final Year Project I	3	C	15	45	NUC
	TOTAL		**16**				

YEAR FIVE: SECOND SEMESTER (POWER SYSTEM ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 502	Engineering Law	2	C	30	-	NUC
2	IMSU-EEE 534	Data Communications and Computer Networks	3	C	45	30	IMSU
3	IMSU-EEE 542	Electrical Power System and Planning	2	C	30	-	IMSU
4	IMSU-EEE 560	Advanced Renewable Energy Systems	2	C	30	-	IMSU
5	IMSU-EEE 544	Electric Drive Systems and Rotating Machine Control	2	C	30	-	IMSU
6	IMSU-EEE 546	Electrical Services Design	1	C	15	15	IMSU
7	EEE 594	Final Year Project II	3	C	-	135	NUC
	TOTAL		**15**				
	SESSIONAL TOTAL		**31**				

YEAR FIVE: FIRST SEMESTER (TELECOMMUNICATION ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 501	Engineering Project Management	3	C	45	-	NUC
2	IMSU-EEE 507	Electrical and Electronic Engineering Analysis	1	C	15	-	IMSU
3	IMSU-EEE 551	Computer Organization and Architecture	2	C	30	-	IMSU
4	IMSU-EEE 561	Modern Control Systems and Design II	2	C	30	-	IMSU
5	IMSU-EEE 573	Telecommunications Engineering, Network Planning and Management	2	C	30	-	IMSU
6	IMSU-EEE 577	Wireless and Mobile Communication, Antenna and Propagation	2	C	45	-	IMSU
7	IMSU-CSD 401	Carrier Services Development	1	C	15	-	IMSU
8	EEE 593	Final Year Project I	3	C	15	45	NUC
	TOTAL		**16**				

YEAR FIVE: SECOND SEMESTER (TELECOMMUNICATION ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 502	Engineering Law	2	C	30	-	NUC
2	IMSU-EEE 534	Data Communications and Computer Networks.	3	C	45	30	IMSU
3	IMSU-EEE 552	Reliability and Maintainability of Electrical and Electronic Systems	1	C	15	15	IMSU

4	IMSU-EEE 560	Advanced Renewable Energy Systems	2	C	30	-	IMSU
5	IMSU-EEE 574	Microwave and Optical Communications	2	C	45	-	IMSU
6	IMSU-EEE 576	Satellite Communication, Radar and Navigation Systems	2	C	30	-	IMSU
7	EEE 594	Final Year Project II	3	C	-	135	NUC
	TOTAL		**15**				
	SESSIONAL TOTAL		**31**				

YEAR FIVE: FIRST SEMESTER (ELECTRONIC AND COMPUTER ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 501	Engineering Project Management	3	C	45	-	NUC
2	IMSU-EEE 507	Electrical and Electronic Engineering Analysis	1	C	15	-	IMSU
3	IMSU-EEE 551	Computer Organization and Architecture	2	C	30	-	IMSU
4	IMSU-EEE 553	Digital Instrumentation	2	C	30	-	IMSU
5	IMSU-EEE 555	Introduction to Operating Systems, Assembly Language Programming	2	C	30	-	IMSU
6	IMSU-EEE 561	Modern Control Systems and Design II	2	C	30	-	IMSU
7	IMSU-CSD 401	Carrier Services Development	1	C	15	-	IMSU
8	EEE 593	Final Year Project I	3	C	15	45	NUC
	TOTAL		**16**				

YEAR FIVE: SECOND SEMESTER (ELECTRONIC AND COMPUTER ENGINEERING OPTION)

S/N	Course Code	Course Title	Units	Status	LH	PH	Remarks
1	GET 502	Engineering Law	2	C	30	-	NUC
2	IMSU-EEE 534	Data Communications and Computer Networks,	3	C	45	30	IMSU
3	IMSU-EEE 552	Reliability and Maintainability of Electrical and Electronic Systems	1	C	15	-	IMSU
4	IMSU-EEE 554	Introduction to VLSI, Semiconductor Technology	2	C	30	-	IMSU
5	IMSU-EEE 556	Industrial Electronic Design	2	C	45	-	IMSU
6	IMSU-EEE 560	Advanced Renewable Energy Systems	2	C	45	-	IMSU
7	EEE 594	Final Year Project II	3	C	-	135	NUC
	TOTAL		**15**				
	SESSIONAL TOTAL		**31**				

11.4 CCMAS Course Description

11.4.1 Serviced Courses

CHM 101: General Chemistry I (3 Units C: LH 45)

Course 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. Rationalise the trends of atomic radii, ionisation 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. Draw shapes of simple molecules and hybridised 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

(Pre-requisite –Good Knowledge of SS1-SS3 Chemistry)

Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation 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.

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)

Course Learning Outcomes

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

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

Course Contents

(Pre-requisite –Good Knowledge of SS1-SS3 Mathematics)

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-Moiré's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

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

Course Learning Outcomes

On completion, the 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

(Pre-requisite –Good Knowledge of SS1-SS3 Physics)

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. 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.

CHM 102: General Chemistry II (3 Units C: LH 45)

Course Learning Outcomes

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

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative of structures in organic chemistry;
5. State rules guiding nomenclature and functional group classes of organic chemistry;
6. Determine the rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry; 8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. Describe basic properties of transition metals.

Course Contents

(Pre-requisite –Good Knowledge of SS1-SS3 Chemistry)

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds; determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry; nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

GET 102: Engineering Graphics and Solid Modelling I (2 Units C: LH 15; PH 45)

Course Learning Outcomes

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

1. Have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple every day and also complex problems;
2. Recognise the fundamental concepts of engineering drawing and graphics;
3. Show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. Analyse such models for strength and cost;
5. Prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. Recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take; and
7. Analyse and master the basics of mechanical and thermal loads in engineering systems.

Course Contents

(Pre-requisite –Knowledge of the Use of Computer)

Introduction to design thinking and engineering graphics. First and third angle orthogonal projections. Isometric projections; sectioning, conventional practices, conic sections and development. Freehand and guided sketching – pictorial and orthographic. Visualisation and solid modelling in design, prototyping and product-making. User interfaces in concrete terms. Design, drawing, animation, rendering and simulation workspaces. Sketching of 3D objects. Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

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

Course Learning Outcomes

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

1. Identify the types of rules in differentiation and integration;

2. Recognize and understand the meaning of function of a real variable, graphs, limits and continuity;
3. Solve some applications of definite integrals in areas and volumes;
4. Solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. Identify the derivative as limit of rate of change;
6. Identify techniques of differentiation and perform extreme curve sketching;
7. Identify integration as an inverse of differentiation;
8. Identify methods of integration and definite integrals; and
9. Perform integration application to areas, volumes.

Course Contents

(Pre-requisite –Good Knowledge of Further Mathematics)

Functions of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson's rule).

PHY 102: General Physics II (Behaviour of Matter) (2 Units C: LH 30)

Course Learning Outcomes

On completion, the 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

(Pre-requisite –Good Knowledge of SS1-SS3 Physics)

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, Zero's 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; Bernoullis equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

IMSU-CSD 102: Career Services Development (1 Unit C: LH 30)

Course Learning Outcomes

On completion, the students should be able to:

1. Have knowledge of origin of career services
2. Understand self-confidence and career development

3. Have knowledge of independence, responsibility and early career planning
4. Explain time management and productivity, personal branding and self - assessment
5. Establish the relationship between leadership and mentorship
6. Highlight various leadership styles/types

Course Contents

(Pre-requisite- Good academic standing)

Career conversations & connections, theories of career education, Self-confidence and Career Development: definition of self-confidence, qualities of self-confidence, types of self-confidence. Independence and responsibilities: meaning of independence and responsibility, manifestation of independence for freshers, signs of responsibility in fresher, challenges to independence and responsibility, students' independence at Tertiary institution. Eaerly Career Planning: steps in career planning, case studies in career planning. Time management and productivity: the 5Ps of time management strategies, time management techniques. Personal Branding and Self-assessment: strengths and weaknesses, importance of self-assessment, brandings and physical appearance. Interest Inventory: career interest inventory, types and essence of interest inventory. Career assessment and administration: definition, importance, purpose and types of career assessment, basic considerations for selecting career assessment tools. Cultural factors influencing career choices among students in Nigeria. Professionalism and Ethics of Teaching (Career Services); Leadership and Mentorship Skills for Students: characteristics of leadership, types of leadership style, leadership functions, traditional perspective on mentoring and mentorship style in higher institution. Technical and Computer Skills Relevant for Career Success: definition of computer skills, types of computer skills and the importance; Decision Making for Freshers.

IMSU-ICT 100: Information & Communication Technologies and Use of Library (1 Unit C: LH 30) XXX

Course Learning Outcomes

On completion, the students should be able to:

1. Understand the basics of Computer and Computer appreciation
2. Have good knowledge of Computer, hardware, software and operating system
3. Understand what Computer virus is all about and its impacts to computers and the society
4. Understand the meaning, origin and types of libraries
5. Understand library resources and services
6. Understand the roles of ICT in library services and library ethics.

Course Contents:

(Pre-requisite – Good academic standing)

Computer Basics and Appreciation: Definition of Computer, Categories of computers and their uses, Various types of computer users, Methods of Data Processing, Basic characteristics of Computer, the importance of Computers, Benefits of using a computer, Advantages of Computer Disadvantages of Computer, Computer History and Development, Early Computing Machines Classification of Computers, Classification of Computers According to Size, Classification of Computers According to functions, Classification of computers according to their purpose.

Types of Computers, Generations of computers, Summary of *Computer Generations and Their Characteristics.* Interrelationship between Binary and Decimal Numbers. The Computer System, Units for measuring computer information or speed. Ways to take care of your computer. Computer Hardware: Peripherals, Parts of a Computer, Input and Output Devices, System unit

Central processing unit (CPU), Memory Unit, Primary Memory, Secondary Memory, Storage Medium, Functional Components of a Computer System.

Computer Software and Operating System: Computer Software, Types of computer Software, Word processors, spread sheets, Image Editors, Database management systems, Presentation applications, Desktop publishing software, operating system, Device Drivers Language Translators, Functions of an Operating System, Categories of an Operating System, Types of Operating Systems, Criteria for Package Acceptability, Modes of Software Acquisition, Operating System – Overview, Parts of Operating System, Elements of Graphical User Interface, Functions of An Operating System, Objectives of Operating System, Need for an Operating System (OS), Reasons for an Operating System. **Computer Virus:** Computer Virus Defined, Historical Backgrounds-Early Theoretical Development (1940-1970), The Emergence of Malicious Viruses (1980s), The Golden Age of Viruses (1990s), The New Age of Cyber Risks (2000s-Present), The Evolution of Viruses: Current Trends and Future, Focus, Current Trends, Future Predictions, Forms of Computer Virus Infection, Operational Mechanisms of Computer Worms and Viruses, Common Payload Activities: Concealment: Evading Detection, Common Concealment Techniques. Symptoms of a Computer Virus, Spread and Prevention Virus, Methods of Disguise, Prevention, Impact of Computer Viruses on individuals, Organizations, Governments and National Security, Healthcare, Economic, Environmental, Psychological and Social Impact. Positive Advancements Emanating from Computer Virus Attacks, Prevention and Protection Against Computer Viruses. **Meaning and Origin of Libraries:** Egyptian Library, Temple Libraries, Royal Libraries, Greek Library, Aristotle Library, The Alexandrian Library,

Library at Pergamum, Roman Libraries, Private Libraries, Public Libraries, Dark Ages, The Middle or Medieval Ages, Monastic Libraries, University Libraries, Renaissance, Modern Libraries, United States of America (USA), Great Britain, France, Germany, Africa. Types of libraries: Public Library, Objectives of and functions Public Libraries, School Library, Academic Library and its functions, National Library and its functions, National Library and its functions, Special Library and its characteristics. **Library Resources and Services:** Library, Human and Financial Resources. Physical Facilities, Information /Material Resources, Types of Information Resources in the Library, Parts of a Book, Library Services, Types of Library Services, Reference Services in the Library, Typical Components of a Reference Service, ICT Services in Libraries, Definition of Concepts, Key Roles of ICT in Library Services, Emerging Trends in Library Technology, Impact of ICT on Library Services, Reprographic Services in Library, Important Aspects of Reprographic Services in Libraries, Library Orientation Services, Library Layout and Services: Library Policies and Procedures, Library Etiquette, Inter-library Loan, Online Research Tools, Importance of Library Orientation Programmes Interlibrary Cooperation Services. **Library Ethics: Rules and Regulations.**

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

Course 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. Describe and explain the first and second laws of thermodynamics, and the concept of entropy;

5. State the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
6. Deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
7. Describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents

(Pre-requisite –PHY 101)

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). Zero's 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).

IMSU-MTH 103: Elementary Mathematics III (Vectors, Geometry and Dynamics)

(2 Units C: LH 30)

Course Learning Outcomes

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

1. Solve some vectors in addition and multiplication;
2. Calculate force and momentum; and
3. Solve differentiation and integration of vectors.

Course Contents

(Pre-requisite –Good Academic Standing)

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface.

IMSU-MTH 104: Elementary Mathematics IV (Coordinate Geometry) (2 Units C: LH 30)

Course Learning Outcomes

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

1. **Define and compute** the distance between two points using coordinate geometry.
2. **Determine** the coordinates of points that divide a line segment in a given ratio.
3. **Explain and calculate** the gradient of a line and apply it to solve related problems.
4. **Formulate** the equation of a straight line in intercept and perpendicular forms.
5. **Apply** coordinate geometry to determine the area of a triangle given its vertices.
6. **Evaluate** the angle between two lines using their gradients.
7. **Derive and explain** the equation of the bisector of an angle between two lines.
8. **State and interpret** the general equation of a circle in coordinate form.
9. **Construct** the equation of a circle passing through three non-collinear points.

10. **Derive and illustrate** the equations of the tangent and normal to a circle.

Course Contents

(Pre-requisite –MTH 101, MTH 103)

Define distance between two points. Explain coordinates of points dividing a line into a given ratio. Define gradient of a line. State equation of a line in intercept form. State equation of a line in perpendicular form. Explain area of a triangle in terms of the coordinates of its vertices. Explain angle between two lines. State and explain the equation of bisector of an angle. State the general equation of a circle. Illustrate the equation of a circle passing through three points. Illustrate the equation of tangent and normal to a circle.

IMSU-MTH 105: Elementary Mathematics V (Mechanics) (2 Units C: LH 30)

Course Learning Outcomes

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

1. **Explain and apply** the concepts of impulse and momentum in solving particle dynamics problems.
2. **Analyze** situations involving conservation of linear momentum in both direct and oblique impacts of elastic bodies.
3. **Define and evaluate** work, power, and energy in mechanical systems.
4. **Apply** the principle of conservation of mechanical energy to practical problems.
5. **Examine** the general motion of a particle in two dimensions, including motion in horizontal and vertical circles.
6. **Model and analyze** simple harmonic motion and the motion of a particle attached to a light inelastic string.
7. **Describe and evaluate** the motion of a rigid body about a fixed axis.
8. **Compute** the moment of inertia of rigid bodies and explain its significance in rotational motion.
9. **Apply** the principles of conservation of energy and angular momentum to rigid body dynamics.
10. **Investigate** the dynamics of a compound pendulum using conservation laws.

Course Contents

(Pre-requisite –Good academic standing)

Impulse and momentum; Conservation of momentum; Work, power and energy. Principle of conservation mechanical energy; Direct and oblique impact of elastic bodies. General motion of a particle in two dimensions; Motion in a horizontal and vertical circles; Simple harmonic motion, motion of a particle attached to a light inelastic string. Motion of a rigid body about a fixed axis; Moment of inertia and diversion. Conservation of energy, compound pendulum, conservation of angular momentum.

IMSU-PHY 104: General Physics IV (2 Units C: LH 30)

Course Learning Outcomes

1. On completion of the course, students should be able to:
2. Describe and quantitatively analyze the behaviour of vibrating systems and wave energy
3. Explain five propagation and properties of waves in sound and light;
4. Identify and apply three wave equations
5. Explain three geometrical optics and principles of optical instruments.
6. Explain Simple harmonic motion (SHM)

Course Contents

(Pre-requisite –PHY 101, PHY 102)

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).

IMSU-HPS 104: History and Philosophy of Science (1 Unit C: LH 45) XXX

Course Learning Outcomes:

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

1. Make sense of the processes of scientific knowledge, technological projects and medical strategies.
2. Create an awareness of the services of science to man and the effects of science on human society.
3. See how why these enterprises exert their powers and how they are trusted, contested and changed.
4. Establish the interrelationship between all disciplines.
5. Explain the nature of man, components of the universe in which he lives and how he obtains energy for his activities.

Course Contents:

(Pre-requisite- Good academic standing)

The nature of Philosophy and Philosophy's concern with other disciplines; What is science? And how it is different from Pseudo-Science; Principles and Assumptions of Science; Foundational Metaphysics and Epistemology of Science; The Methods and Features of Science; The problems with Science; The theories of Scientific Progress; Philosophy of the Social Science; Philosophy, Science and Development in Africa; Science, Technology and Inventions; Social implications of technological advancement; Man and his Origin; Man and his Environment; Man and his sources of Energy; Climate Change

CHM 107: General Practical Chemistry I (1 Unit C: PH 45)

Course Learning Outcomes

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

1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correct carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. State the differences 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

(Pre-requisite –CHM 101, CHM 102)

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

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

Course Learning Outcomes

On completion, the student 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

(Pre-requisite –PHY 101, PHY 102, PHY 103)

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.

IMSU-SGB 107: Basic Igbo (1 Units C: LH 15)

Course Learning Outcome:

1. To engender students' communicative skills in Igbo.
2. To assist students to acquire the rules of Igbo grammar in their writing.
3. To develop students' interest in Igbo as a special, indigenous Nigerian language.
4. To encourage students' appreciation of basic literary works in Igbo.
5. Read and demonstrate good comprehension of texts in the language
6. Read and write two compositions in Igbo language with standard orthography.
7. Demonstrate understanding of word formation processes in the language
8. Demonstrate proper usage of Igbo language.
9. Identify the five dramatic elements in traditional drama in the language

Course Contents

(Pre-requisite –Good Knowledge of JS1-SS3 Igbo)

NHAZI QMXMX

Nqm; Wiik.	**Isiqmxmx**	**Nd[niime Qmxmx**
1.	Ndubata; Mkpxrxab[d[[	Ozi ekele; {kpqlite mmas[gbasara mmxta asxsx Igbo. {gxpxta na idepxta Ab[[d[Igbo;

		Iwu Ndakqr[ta Xdaume: Nnupx Isi n'Iwu Ndakqr[ta Xdaume; Myirixdaume; Mgbochiume (Mkp[, Xdaqnx na Xdaimi); Mkpxrxab[[d[Igbo na Mkpxrxokwu; Mkpxrxab[[d[Igbo na Ah[r[okwu. Qrxnka Ab[[d[na Mkpxrxab[[d[.
2.	Nkejiasxsx: Aha na Nnqchiaha:	Nkenxxd[Aha: - Ahaaka na Ahaizugbe; - Ahaìgwè na Ahauche. - Odide Nkejiasxsx Aha n'ah[r[okwu. Nkenxd[Nnqchiaha I: - Pesin na Ngx; - Nnqchimpesin; - Nnqchiaha na Ndakqr[ta Xdaume; - Nnqchiaha na ah[r[okwu; Nkenxxd[Nnqchiaha II: - Nnqchionye - Nnqchimpesin - Nnqchinke - Nnqchionwe Odide Nnqchiaha n'ah[r[okwu. Nnqchiaha na Xdaolu. Qrxnka Aha. Qrxnka Nnqchiaha.
3.	Nkejiasxsx Mbuxzq na Njikq:	Odide Mbuxzq n'ah[r[okwu. Nkenxxd[Njikq; Njikq n'ah[r[okwu; Nd[iche d[n'etiti Mbuxzq "na" nakwa Njikq "na". Nd[iche d[n'etiti Mbuxzq "na" nakwa Nnyemaka Ngwaa "na". Qrxnka Mbuxzq.

		Nkenxxd[Mbuxzq; Qmxmaatx Mbuxzq; Odide Njikq n'ah[r[okwu; Nd[iche d[n'etiti Njikq "na" nakwa Mbuxzq "na". Nd[iche d[n'etiti Njikq "na" nakwa Nnyemaka Ngwaa "na". Qrxnka Mbuxzq; Qrxnka Njikq.
4.	Nkejiasxsx Nkqwaaha na Nkwuwa:	Nkenxxd[Nkqwaaha: - Nkqwa - Nrxaka - Mkpokqta. Odide Nkqwaaha n'ah[r[okwu. Ejirimara Nkqwaaha. Nkenxxd[Nkwuwa: - Keoge - Keqd[d[- Keuchexda - Kensokwxnye - Kengwaa - Keugboro ugboro. Odide Nkwuwa n'ah[r[okwu. Qrxnka Nkqwaaha; Qrxnka Nkwuwa.
5.	Njxajxjx, Qnxqgxgx na Ntimkpu	Nkenxxd[Njxajxjx; Odide Njxajxjx n'ah[r[okwu. {kpqpxta Qnxqgxgx: Otu ruo Ijeri; Mgbakq Qnxqgxgx: - Qnxego; - Qnxoge; - Qnxole; - Nqmba (Nqmba Nzuruoke, Nqmba na Nqmba Qnxmpekele. Nkenxd[Nqmba Qnxmpekele: - Nqmba Qnxmpe - Nqmba Qnxqgwa

		Nqmba Mweabxq na Nqmba Nsqabxq Ngxnke; Qnxafq; Ndubata Qnxqgx Sqqm. Nkenxxd[Ntimkpu; Ntimkpu n'ime ah[r[okwu. Xdaolu n'ime Njxajxjx; Xdaolu n'ime Qnxqgxgx; Xdaolu n'ime Ntimkpu. Qrxnka Njxajxjx, Qnxqgxgx, Ntimkpu.
6.	Nnwale n'ime etiti semesta:	Mkpxrxab[[d[; Aha; Nnqchiaha; Mbuxzq; Njikq; Nkqwaaha; Nkwuwa; Njxajxjx; Qnxqgxgx; Ntimkpu;
7.	Nkejiokwu na Xdaolu:	Nkenxxd[Nkejiokwu; Mmebere Nkejiokwu; Nkejiokwu n'ime mkpxrxokwu; Nkejiokwu n'ime ah[r[okwu; Nkenxxd[Xdaolu; Xdaolu n'ime Nkejiokwu; Xdaolu n'ime Mkpxrxokwu; Xdaolu n'ime ah[r[okwu; Xdachi; Xdanusoro; Xdaolu n'ime Mfinitiivu. Qrxnka Nkejiokwu; Qrxnka Xdaolu.
8.	Nkejiasxsx Ngwaa:	Isingwaa; Nsinangwaa: - Mfinitiivu - Enyemaaka Ngwaa; - Omekangwaa; - Jerqnd; - Omee. Xdaolu n'ime Ngwaa. Qrxnka Ngwaa.

9.	Mgbakwxnye:	Nganiiru; Nnqneetiti; Nsonaazu; Nsokwunye. Qrxnka Mgbakwxnye.
10.	Akaraedemede:	Kpqm; R[kqm ala maqbx kqma; R[kqm elu; Kpqr[kqm; Kpqmkpqm; Akara uhie; Zam; Akaramkpu; Akaraajxjx; Akara igbe; Akara nkepxta. Qrxnka Akaraedemede.
11.	Ah[r[okwu:	i) Ah[r[mfe - Ah[r[Otu Mkpxrxokwu; - Ah[r[Mkpxrxokwu Olemole; - Ah[r[nkwusa; - Ah[r[njx; - Ah[r[ajxjx; - Ah[r[ntimiwu; - Ah[r[nchq; - Ah[r[ntimkpu. ii) Ah[r[ukwu iii) Ah[r[nha. Qrxnka Ah[r[okwu.
12.	Mkpqaha, Nkebiokwu na Nkebiah[r[:	i) Nkenxd[Mkpqaha. ii) Nkenxd[Nkebiokwu: - Nkebiokwu Keaha; - Nkebiokwu Kenkqwaaha; - Nkebiokwu Kejerqndx; - Nkebiokwu Kembuxzq; - Nkebiokwu Kengwaa; - Nkebiokwu Kemfinitiivu, dgz. iii) Nkenxd[Nkebiah[r[: - Nkebiah[r[Keaha; - Nkebiah[r[Kenkqwa; - Nkebiah[r[Kenkwuwa.

		Qrxnka Nkebiah[r[; Qrxnka Nkebiokwu; Qrxnka Mkpqaha.
13.	Mqf[m:	Qmxmaatx Mqf[m; Nkenxxd[Mqf[m: – Nnqqrqonwe; – Ndabe: - Nganiiru; - Nnqneetiti; - Nsonaazx. Qrxnka Mqf[m.
14.	Qgxgx Igbo:	Ijiri nkenke agxmagx d[icheiche, wee gosipxta obibi ndx nd[Igbo, d[ka: – Ekele d[icheiche; – Nri d[icheiche; – Mmiri na Iyi d[icheiche; – {gba mbq; – Nzukq; – Uri na egwu Igbo; – Ndx qma.
15.	Mmxghar[na Ule:	– Ndepxta; – Ngxpxta; – Nch[kqta; – Ule.

CHM 108: General Practical Chemistry II (1 Unit C: PH 45)

Course Learning Outcomes

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

1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correctly carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. Identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. Carry out solubility tests on known and unknown organic compounds;
6. Carry out elemental tests on known and unknown compounds; and
7. Carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

Course Contents

(Pre-requisite –CHM 107)

Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

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

Course Learning Outcomes

On completion, the student 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

(Pre-requisite –PHY 107)

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.

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

Course 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

(Pre-requisite –Sound academic standing)

Sounds and sound patterns in English Language (vowels and consonants, phonetics and phonology); English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations); major word formation processes; the sentence in English (types: structural and functional); grammar and usage (tense, concord and modality). Reading and types of reading, comprehension skills, 3RsQ. Logical and critical thinking; reasoning methods (logic and syllogism, inductive and deductive argument, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing activities (pre-writing (brainstorming and outlining), writing (paragraphing, punctuation and expression), post- writing (editing and proofreading). Types of writing (summary, essays, letter, curriculum vitae, report writing, note-making). etc. Mechanics of writing. Information and Communication Technology in modern language learning. Language skills for effective communication. The art of public speaking.

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)

Course Learning Outcomes

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

1. Analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. Identify and list the major linguistic groups in Nigeria;

3. Explain the gradual evolution of Nigeria as a political entity;
4. Analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;
5. Enumerate the challenges of the Nigerian state regarding nation building;
6. Analyse the role of the judiciary in upholding fundamental human rights
7. Identify the acceptable norms and values of the major ethnic groups in Nigeria; and 8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents

(Pre-requisite –Good academic standing)

Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic 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). Concepts of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian 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 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, 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.

IMSU-SGB 112: Readings and Practice in **Igbo** **(1 Units C: LH 15)**

Course Learning Outcomes:

1. To expose students to different styles of writing in Igbo.
2. To encourage students' hands-on practices in one or more areas of Igbo study including poetry, prose, drama, short story, an interview session in Igbo, to mention a few.
3. To encourage students' participation in enriching Igbo vocabulary through translating new forms and terminologies into Igbo.
4. To deepen students' interest in the use of Igbo for various communicative purposes.

Course Contents

(Pre-requisite –SGB 107)

NHAZI QMXMX

Nqm. Wiik	**Isiqmxmx**	Nhazi Qmxmx
1.	Ndubata:	Ntxleghar[Isiqmxmx SGB 107 na Simesta Mbx.

2.	Edemede:	Edemede: Akxkq, Leta, Okwunqha.
3.	Atxmatx Okwu na Asxsx Nka:	Atxmatx Okwu: - Ilu; - Xkabxilu; - As[niilu; - Akpaalaokwu. Asxsx Nka: - Myiri; - Mbxrx; - Egbeokwu; - Kwunkwukwa; - Mmemadx; - dgz.
4.	Agxmagx Qd[naala:	Qmxmaatx nakwa [txle: - Akxkq Qd[naala; - Ejije Qd[naala; - Abx Qd[naala.
5.	Agxmagx Ederede:	Qmxmaatx nakwa [txle: - Iduaz[; - Ejije Ederede; - Abx Ederede.
6.	Ntxghar[na Qkqwaokwu:	Ntxghar[mkpxrxokwu; Ntxghar[ah[r[okwu; {txle Qkqwaokwu d[icheiche e nwere n'Igbo.
7.	Nnwale n'ime etiti semesta.	Edemede; atxmatx okwu; asxsx nka; agxmagx qd[nala; agxmagx ederede; ntxghar[; qkqwaokwu.
8.	Edemede Okwunka na okwu qhxrx:	- Qmxmaatx Okwunka d[iche iche; - Odide Okwunka; - {chqpxta Okwunka nakwa okwu qhxrx.
9.	Okwunqha:	- Nkenxxd[Okwunqha; - Itinye Atxmatx Okwu n'Okwunqha - Itinye Asxsx Nka n'Okwunqha.
10.	Edechaagxq, Qrxqha na Nkangosi:	Nduzi keesiede iduaz[, abx maqbu ejije;
11.	Edechaagxq; Qrxqha na Nkangosi:	Nkqwa na ngosi ihe nd[a: - Iheqkpx (ngwaejirimara); - Eserese; - Ngwanchara;

		Ijiri iheqkpx, eserese, na ngwanchara mee ngosi, site n'[gx, maqbx igosi ihe nd[a.
12.	Edemede Ajxjxqnx, Ntaakxkq na Qrxnka:	Nta mmxta maqbx ntaakxkq n'ime Mahadum. Ijiri Igbo wee dee ihe nchqpxta; Ijiri Igbo wee dee ihe e zutere na njemqrx na njem nchqpxta.
13.	Ihe Qmxmx Igbo n'me Nkanufere I:	Ijiri kqmputa dee Igbo; Ngwaqrx kqmputa maka Igbo; Mkpxrxasxsx Igbo n'ime kqmputa;
14.	Ihe Qmxmx Igbo n'ime Nkanufere II:	Igbo n'ime whatsapp; Igbo n'ime facebook; Igbo n'ime google.
15.	Mmxghar[na ule	Ngxpxta; Ndepxta; Ngosi; Nch[kqta; Ule

IMSU-STA 112: Probability I (3 Units C: LH 45)

Course Learning Outcomes

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

1. Explain three differences between permutation and combination;
2. Explain the concept of random variables and relate it to probability and distribution functions
3. Define probability laws, conditional probability, and independence;
4. Describe Bayes' theorem and explain three basic probability distribution for discrete and continuous random variables;
5. Compute expectations and moments of random variables;
6. Explain Chebyshev's inequality and apply it to real life situations;
7. Explain joint marginal, conditional distributions and moments as well as Limiting distributions;
8. Describe standard distributions, moments and moment-generating functions; and explain laws of large numbers and the central limit theorem.

Course Contents

(Pre-requisite –Good Mathematical Knowledge)

Permutation and combination. Concepts and principles of probability. probability laws. conditional probability, independence. Bayes' theorem. Probability and distribution functions of discrete and continuous random variables: binomial, Poisson, geometric, hypergeometric, rectangular (uniform), negative exponential, binomial. Expectations and moments of random variables. Chebyshev's inequality. joint marginal and conditional distributions and moments. limiting distributions. discrete

and continuous random variables, standard distributions, moments and moment-generating functions. laws of large numbers and the central limit theorem.

Probability and statistics, mutually exclusive events, independent events, the binomial probability distribution. Dependent events, mathematical expectation, permutations combinations, factorial n, stirling's approximation to N.

IMSU-CHM 114: Physical Chemistry (2 Units C: LH 30)

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Course 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 generation and financial independence;
4. Engage in entrepreneurial thinking;
5. Identify key elements in innovation;
6. Describe the stages in enterprise formation, partnership and networking, including business planning;
7. Describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. State the basic principles of e-commerce.

Course Contents

(Pre-requisite –Good academic standing)

The 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 destruction); 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 (The 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 alliance formation, and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office and 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.

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

Course Learning Outcomes

At the end of the course, students 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,
8. Guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents

Pre-requisite –Good academic standing)

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

Course 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 a 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; and 9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

(Pre-requisite –Good academic standing)

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, E-commerce 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), block chain, cloud computing, renewable energy, etc. Digital business and e-commerce strategies).

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

Course Learning Outcomes

At the end of this 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; and
5. Describe the roles of international organisations, media and traditional institutions in peace building.

Course Contents

(Pre-requisite –Good academic standing)

The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, 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, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal framework: 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) (dialogue, arbitration, negotiation, collaboration, etc). The 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). The media and traditional institutions in peace building. Managing post-conflict situations/crises: Refugees. Internally Displaced Persons (IDPs); the role of NGOs in post-conflict situations/crises.

IMSU-CSD 401: Career Services Development (1 Unit C: LH 15)

Course Learning Outcomes

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

1. Establish the difference and relationship between self-confidence and self-consciousness
2. State types of career counselling, assessment and exploration, benefits of virtual career counselling.
3. Understand job search strategies, tools and resources for job market research
4. Explain ethics, legal dimensions and contractual obligations in career services
5. Outline challenges to early career professionals
6. Understand types, benefits and challenges of internships and freelancing
7. Outline types and techniques of mentoring and roles of mentors

Course Contents

(Pre-requisite –Good academic standing)

The Human Perspective in Career Development; Self-confidence Development Through Communication; Career Counseling, Assessment and Exploration; Active Job Search; Ethical and Legal Dimensions to Career Choice and Development; Early Career Professionals: Resilience and Adaptability to Career challenges; Broader Perceptives to Career Choices; Growth and Development at Work; Basics of the World of Work; Diversification of Career Choices in Agriculture; Feasibility Study for Career Planning; Resume Writing and Interview Preparation.

11.4.2 General Engineering Coded Courses

GET 101: Engineer in Society (1 Unit C: LH 15)

Couse Learning Outcomes

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

1. Differentiate between science, engineering and technology, and relate them to innovation;
2. Distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. Identify and distinguish between the relevant professional bodies in engineering;
4. Categorise the goals of global development or sustainable development goals (SDGs); and
5. Identify and evaluate safety and risk in engineering practice.

Course Contents

(Pre-requisite –Good academic standing)

History, evolution and philosophy of science. engineering and technology. The engineering profession – engineering family (engineers, technologists, technicians and craftsmen), professional bodies and societies. Engineers' code of conduct and ethics, and engineering literacy. Sustainable development goals (SDGs), innovation, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

IMSU-GET 105: Engineering Drawing (1 Unit C: PH 45)

Course Learning Outcomes

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

1. Understand the fundamentals of engineering drawing
2. Demonstrate proficiency in basic drawing tools and techniques
3. Interpret and analyze technical drawings
4. Apply drawing standards and conventions
5. Create 2D orthographic projections and isometric views
6. Understand geometric dimensioning and tolerancing (GD&T)
7. Use proper dimensioning and annotation techniques
8. Demonstrate problem-solving skills through engineering drawings apply the concept of engineering drawings to real-world applications

Course Contents

(Pre-requisite –Knowledge of Construction in SS2-SS3 Mathematics or Technical Drawing)

Graphic Tools, Introduction of Drawing, measuring. Lettering and dimensions of objects in various positions. Sketching, Engineering geometry, fundamentals orthographic projections. Graphs, charts and presentation of data and results.

Guided sketching, freehand drawing, creative thinking and multi-view representation. Revolution and conventional practice. Sectional and auxiliary views. Spatial relationships; basic descriptive geometry, vector geometry; developments and intersections, pictorial presentation.

IMSU-GET 121 Workshop Practice I (1 Unit C: LH 15 P 45)

Course Learning Outcomes

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

1. Observe safety precaution in the workshop.
2. Operate safety equipment e.g. fire extinguisher, safety water hose etc.
3. Use of personal protective equipment.
4. Observe all safety rules and regulations.
5. Use the marking out tools very well.
6. Produce simple objects by using the bench and hand tools.
7. Read the micrometer screw gauge, Vernier calipers etc.

Course Contents

(Pre-requisite –Good academic standing)

Behaviour Analysis: Safety consciousness, survey of sources of accidents, general safety instructions, Use of Engineering of measuring instruments, Calipers, micrometer screw guage, sine bars, angular measuring, etc, sampling and sizing techniques of raw materials, introduction to hand tools, bench tools, power tools, and wood working tools, Bench work: marking out, cutting, filling, drilling. Assignment: production of (i) a simple door stapler (ii) chair/table

IMSU-GET 122 Workshop Practice II (1 Unit C: LH 15; PH 45)

Course Learning Outcomes

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

1. Identify and draw different types of plant layout,
2. Identify and produce different types of joints, using rivets, and screws and produce internal and external thread forms,
3. Cut, slot and file straight and curved profiles.
4. Perform a range of operations on workshop machinery, e.g., Drills, Lathe, Mills, and Grinders
5. Form an internal and external threads by use of taps and dies
6. Operate equipment and tools in metal workshop and distinguish between their application
7. Participate in workshop activities individually as well as in a group
8. Turn jobs on the lathe, parallel, taper, and face turning etc
9. Select spindle speeds, feeds, and coolant.
10. Operate equipment and tools in wood workshop and distinguish between their application
11. Show the general purpose and precision colour codes resistors
12. Identify the standard symbols for some of the circuit elements

Course Contents

(Pre-requisite –IMSU-GET 121)

Sheet metal work: layout, plant layout, cutting, shaping, welding, Design of simple jigs and fixtures. Basic wood-working principle, introduction to machine shop; lathe work, shaping, milling, grinding, drilling, and metal spinning, thread and thread cutting, power press, design of die elements, simple Automobile diagnosis and repairs, Electrical Workshop practice: Convention and application of colours, codes, and signs, etc. Use of electrical tools, machines, cables and conductors.
Projects: Safe manufacture and production of five projects involving all aspects of machine-shop applications including drilling, lathe, milling, surface grinding to the tolerances shown on drawings.

IMSU-GET 201: Applied Electricity I (3 Units C: LH 45)

Course Learning Outcomes

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

1. Discuss the fundamental concepts of electricity and electrical d.c. circuits;
2. State, explain and apply the basic d.c. circuit theorems; 5. explain the basic a.c. circuit theory and
3. Apply to solution of simple circuits.

Course contents

(Pre-requisite – Knowledge of PHY 101 and Good academic standing)
Fundamental concepts: Electric fields, charges, magnetic fields. current, B-H curves Kirchhoff's laws, superposition. Thevenin Norton theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurement, Transducers, Single phase circuits, Complex j - notation, AC circuits, impedance, admittance, and susceptance.

IMSU-GET 202: Engineering Materials (3 Units C: LH 45)

Course Learning Outcomes

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

1. Demonstrate the role of atoms and molecules (aggregates of atoms) in the building of solid/condensed matter known as engineering materials, the electrons quantum numbers and how the electrons are arranged in different atomic elements, and explain the role of electronic configuration and valence electrons in bonding;
2. Define metals, alloys and metalloids, demonstrate mental picture of the solid mineral resources development as a relay race among four 'athletes': geologist, mining engineer, mineral processing technologist, process metallurgical engineer, and classify metallurgical engineering into 3Ps: process, physical and production;
3. Explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions;
4. Define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries;
5. Define and classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerisation reactions, their types and mechanism, and applications of polymers;
6. Define properties, types and application of composite materials and fibres (synthetic and natural);

7. Define and classify nanomaterials, demonstrate applications of nanomaterials, concept, design and classification of fracture mechanics, corrosion classification, including the five principal ways of controlling corrosion and metal finishing processes such as sherardising, galvanising and anodising; and
8. Identify factors affecting the performance and service life of engineering materials/metals and metallography of metals/materials (materials anatomy), which enables metallurgical and materials engineers to prescribe appropriate solutions to test metals/materials fitness in service through structure-property-application relationships.
9. Explain the characteristics of phase diagrams and phase transformations of solid solutions (alloys);
10. Determine the components and compositions of phase diagrams and phase transformations of solid solutions (alloys);
11. discuss the different types, causes and effects of corrosion and methods of its prevention and mitigation;

Course Contents

(Pre-requisite –Good academic standing)

Basic material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughing mechanism for ceramics. Polymers; definition of polymers as engineering materials, chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Corrosion: types, causes and effects of corrosion, corrosion prevention and mitigation. Fabrication processes and applications. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of engineering design, engineering materials processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, x-ray and eddy current.

IMSU-GET 203: Engineering Graphics and Solid Modeling II (3 Units C: LH 30 PH 45)

Course Learning Outcomes

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

1. Apply mastery of the use of projections to prepare detailed working drawing of objects and designs;
2. Develop skills in parametric design to aid their ability to see design in the optimal specification of materials and systems to meet needs;
3. Analyze and optimize designs on the basis of strength and material minimization;

4. Get their appetites wet in seeing the need for the theoretical perspectives that create the basis for the analysis that are possible in design and optimization, and recognize/understand the practical link to excite their creativity and ability to innovate; and
5. Translate their thoughts and excitements to produce shop drawings for multiphysical, multidisciplinary design.

Course Contents

(Pre-requisite –GET 102)

Projection of lines, auxiliary views and mixed projection. Preparation of detailed working production drawing; semi-detailed drawings, conventional presentation methods. Solid, surface and shell modeling. Faces, bodies and surface intersections. Component-based design. Component assembly and motion constraints. Constrained motions and animation. Introduction to electronics modeling. Electronics board layout preparation, Component libraries and Schematic design. Parametric modeling and adaptive design. Simulation for material optimization. Designing for manufacturing. Additive and subtractive manufacturing. Production for 3-D printing, Laser cutting and CNC machinery. Arrangement of engineering components to form a working plant (Assembly Drawing of a Plant).

GET 204: Students Workshop Practice (2 Units C: LH 15; PH 45)

Course Learning Outcomes

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

1. Identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance;
2. Practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. Master workshop and industrial safety practices, accident prevention and ergonomics;
4. Physically recognise different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. Connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. Determine household and industrial energy consumption, and understand practical energy conservation measures.

Course Contents

(Pre-requisite –IMSU-GET 121, IMSU-GET 122)

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes (welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines.

Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 205: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

Course Learning Outcomes

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

1. Explain the properties of fluids;
2. Determine forces in static fluids and fluids in motion;
3. Determine whether a floating body will be stable;
4. Determine the effect of various instruments, (valves, orifices, bends and elbows) on fluid flow in pipes;
5. Measure flow parameters with venturi meters, orifice meters, weirs and others;
6. Perform calculations based on principles of mass, momentum and energy conservation;
7. Perform dimensional analysis and simple fluid modelling problems; and
8. Specify the type and capacity of pumps and turbines for engineering applications.

Course Contents

(Pre-requisite –Good academic standing)

Fluid properties, hydrostatics, fluid dynamics using principles of mass, momentum and energy conservation from a control volume approach. Flow measurements in pipes, dimensional analysis, and similitude, 2-dimensional flows. Hydropower systems.

GET 206: Fundamentals of Engineering Thermodynamics (3 Units C: LH 45)

Course Learning Outcomes

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

1. Describe basic concepts of thermodynamics, quantitative relations of Zeroth, first, second and third laws;
2. Define and explain system (surrounding, closed and open system), control volume and control mass, extensive and intensive properties;
3. Calculate absolute and gage pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;
4. Evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,
5. Formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. Calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. Apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;

9. Formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. Construct energy and mass balance for unsteady-flow processes;
11. Evaluate thermodynamic applications using second law of thermodynamics;
12. Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. Restate perpetual-motion machines, reversible and irreversible processes.

Course Contents

(Pre-requisite –Good academic standing)

Basic concepts, definitions and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot; thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiencies.

IMSU-GET 207: Applied Mechanics (3 Units C: LH 45)

Course Learning Outcomes

At the end of this course, students will acquire the ability to:

1. Explain the fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
2. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, mathematics and applied mechanics;
3. Synthesize Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load; and
4. Apply engineering design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Course Contents

(Pre-requisite –Good academic standing)

Forces, moments, couples. Equilibrium of simple structures and machine parts. Friction. First and second moments of area; centroids. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energy and momentum analyse

IMSU-GET 208: Strength of Materials (3 Units C: LH 45)

Course Learning Outcomes

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

1. Recognize a structural system that is stable and in equilibrium;
2. Determine the stress-strain relation for single and composite members based on Hooke's law;

3. Estimate the stresses and strains in single and composite members due to temperature changes;
4. Evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
5. Determine bending stresses and their use in identifying slopes and deflections in beams;
6. Use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
7. Evaluate the stresses and strains due to torsion on circular members; and
8. Determine the buckling loads of columns under various fixity conditions at the ends.

Course Contents

(Pre-requisite –IMSU-GET 207)

Consideration of equilibrium; composite members, stress-strain relation. Generalised Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force, bending moments and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations and Mohr's circle. Elastic buckling of columns.

GET 209: Engineering Mathematics I (3 Units C: LH 45)

Course Learning Outcomes

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

1. Solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. Describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. Solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. Describe the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of Gauss, Stoke's and Green's theorem;
5. Explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and
6. Analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

Course Contents

(Pre-requisite –MTH 102, MTH 104)

Limits, continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions, matrices and determinants, vector algebra, vector calculus, directional derivatives.

GET 210: Engineering Mathematics II (3 Units C: LH 45)

Course Learning Outcomes

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

1. Describe physical systems using ordinary differential equations (ODEs);

2. Explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types;
3. Numerically solve differential equations using MATLAB and other emerging applications;
4. Perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
5. Solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;
6. Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering; and
7. Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.

Course Contents

(Pre-requisite –MTH 102)

Introduction to ordinary differential equations (ODEs); theory, applications, methods of solution; second order differential equations. Advanced topics in calculus (vectors and vector-valued function, line integral, multiple integral and their applications). Elementary complex analysis including functions of complex variables, limits and continuity. Derivatives, differentiation rules and differentiation of integrals. Cauchy-Riemann equation, harmonic functions, basic theory of conformal mapping, transformation and mapping and its applications to engineering problems. Special functions.

GET 211: Computing and Software Engineering (3 Units C: LH 30; PH 45)

Course Learning Outcomes

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

1. Describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. Develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. Use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. Develop skills in eliciting user needs and designing an effective software solution;
5. Recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalisation of services; and
6. Acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

Course Contents

(Pre-requisite –Knowledge of Use of Computer and good academic standing)

Introduction to computers and computing; computer organisation – data processing, memory, registers and addressing schemes; Boolean algebra; floating-point arithmetic; representation of non-numeric information; problem-solving and algorithm development; coding (solution design using

flowcharts and pseudo codes). Data models and data structures; computer software and operating system; computer operators and operator's precedence; components of computer programs; introduction to object oriented, structured and visual programming; use of MATLAB in engineering applications. ICT fundamentals, Internet of Things (IoT). Elements of software engineering.

IMSU-GET 221 Engineering Laboratory I (1 Unit C: LH 15 PH 45)

Course Learning Outcomes

1. Upon completion of this course, the students should be able to:
2. Practically measure the coefficient of friction between steel plane and various engineering materials.
3. Explain frictional effects using an inclined plane.
4. Practically determine the forces required to support moving and static bodies on inclined plane.
5. Use data to verify the belt friction law.
6. Determine the elasticity of a given rubber band.
7. Determine the stiffness of a specimen spring wire and modulus of rigidity of a given spring wire.
8. Practically determine the modulus of rupture of various timber beams
9. Take required steps and determine the values of the shear modulus of elasticity for given specimens of steel, brass and aluminum.
10. Measure or estimate the toughness of a material or a test specimen by Charpy test.
11. Take practical steps and determine the endurance limit of specimen of a metal.
12. Determine the hardness of mild steel plate, carbon steel plate and aluminum plate specimens.
13. Describe the macro structure of aluminum ingot sections and state the relationship between the freezing rate of specific areas of any casting.
14. Use the magnetic particle method and detect surface cracks.
15. Describe the microstructure of metallic elements by viewing under a microscope and hence provide information on the material, its history and properties.
16. State the nature and measure the relative magnitudes of the forces in the members of the jib-crane.
17. Use the related apparatus and determine the velocity ratio for a given machine and determine the variation with load of the efforts, friction load and efficiency for the given machine.
18. Take practical steps and determine the mechanical efficiency of power transmission by a given flat belt.
19. Determine the radius of gyration about the mass-centre of a rigid body and calculate the gravitational acceleration in the locality of action.
20. Set up a solar energy scheme and use it to generate potable water from sea or river water.
21. Determine the thermal conductivities of various insulating materials.
22. Quantitatively verify the law of linear motion.

Course Contents

(Pre-requisite –Good academic standing)

a. Assigned laboratory exercises to reflect the basic engineering courses in:
b. Engineering Mechanics
c. Materials Science

d. Engineering Thermodynamics 1
e. Basic land survey

Guidance on specific experiments and calculations will be provided by the lecturer.

IMSU-GET 222 Engineering Laboratory II (1 Unit C: LH 15 PH 45)

Course Learning Outcomes

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

1. Determine, in real terms, the support reactions for a simply-supported beam with point load.
2. Practically calculate the variation of deflection of a simply-supported beam with load, beam thickness and beam material.
3. Calculate the elasticity of a specimen of rubber band based on laboratory data.
4. Calculate the modulus of rupture of various timber beams specimens based on laboratory data.
5. State the relationship between torsional moment and the angle of twist of a shaft.
6. Determine the value of the shear modulus of elasticity for steel, brass and aluminium based on laboratory data.
7. Measure inductance and capacitance by Wheatstone bridge.
8. a. Measure fusing current in a circuit.
   a. Know the relationship between fusing current and the length of fuse wire.
   b. Know relationship between fusing current and diameter of the fuse wire.
   c. Describe the effect of straining on fusing current.
   d. Clearly state time-current dependence of a circuit breaker.
9. Confirm experimentally, some of the basic electrical network theorems and laws such as Kirchoff's law, superposition and Thevenin theorems.
10. Confirm the maximum power transfer theorem.
11. Describe the relationship between transformer coils windings (number of turns) ratio and voltage output.
12. Confirm the validity of Hooke's law for elastic materials.
13. Determine the endurance limit of a specimen of a metal.
14. Determine the hardness of mild steel plate, carbon steel plate and aluminum plate specimens.
15. Vary the compressor speed and load of a refrigeration system and correspondingly clearly state how the compressor speed changes with the following parameters:
    i. Compressor power
    ii. Refrigerating effect
    iii. COPR
    iv. Heat reject speed condenser
    v. Compressor efficiency: volumetric, isentropic, mechanical.
16. Understand the validity of theoretical quantifications for the force exerted by a jet of fluid on targets of different shapes.
17. Understand the change in pressure drop due to liquid viscosity along a circular pipe in relation to the mean flow velocity in the pipe.

Course Contents

(Pre-requisite –IMSU-221)

Assigned laboratory exercise to reflect the basic Engineering courses in:

a) Strength of materials
b) Fluid mechanics I

c) Basic Engineering materials
d) Basic Electrical Engineering

Guidance on specific experiments and calculations will be provided by the lecturer.

GET 299: Students Industrial Work Experience I (3 Units C: 9 weeks)

Course Learning Outcomes

SIWES should provide opportunity for the students to:

1. Acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
2. Learn and practise basic engineering techniques and processes applicable to their specialisations;
3. Build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and
4. Acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

Course Contents

(Pre-requisite –Good academic Standing)

Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation, (8-10 weeks during the long vacation following 200 level).

NOTE: Each programme to indicate additional details of programme-specific activities for their students.

GET 301: Engineering Mathematics III (3 Units C: LH 45)

Learning Outcomes

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

1. demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. develop simple algorithms and use computational proficiency;
4. write simple proofs for theorems and their applications; and
5. communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

Course Contents

Linear Algebra. Elements of Matrices, Determinants, Inverses of Matrices. Theory of Linear Equations. Eigen Values and Eigen Vectors. Analytical Geometry. Coordinate Transformation. Solid Geometry. Polar, cylindrical and spherical coordinates. Elements of functions of several variables. Surface Variables. Ordinary Integrals. Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals. Derivation and Integrals of Vectors. The gradient of scalar quantities. Flux of Vectors. The curl of a vector field, Gauss, Greens and Stoke's theorems and applications. Singular Valued Functions. Multivalued Functions. Analytical Functions. Cauchy Riemann's Equations.

Singularities and Zeroes. Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.

GET 302: Engineering Mathematics IV (3 Units C: LH 45)

Learning Outcomes

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

1. solve second order differential equations;
2. solve partial differential equations;
3. solve linear integral equations;
4. relate integral transforms to solution of differential and integral equations;
5. explain and apply interpolation formulas; and
6. apply Runge-Kutta and other similar methods in solving ODE and PDEs.

Course Contents

Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equations with variable coefficients. Sturn-Louville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and Linear integral equations. Integral transforms and their inverse including Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 304: Technical Writing and Communication (3 Units C: LH 45)

Course Learning Outcomes

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

1. Demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. Demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection, and problems in engineering communication and presentation; and
3. Demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Contents

(Pre-requisite –Good academic standing)

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis, structure Fog and Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A, B, C, D, E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organisation of reports. Technical report writing skills (steps, problems in writing, distinguishing technical and other reports, significance, format and styles of writing technical reports). Different formats for communication; styles of correspondences – business report and proposal, business letter,

memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports (competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

GET 305: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes

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

1. work with data from the point of view of knowledge convergence, machine learning, and intelligence augmentation, which significantly raises their standard for engineering analysis (the approach forces them to learn statistics in an actionable way that helps them to see the holistic importance of data analytics in modern engineering and technology);
2. anticipate the future with Artificial Intelligence while fulfilling the basic requirements of conventional engineering statistical programming consistent with their future careers;
3. perform, with proficiency, statistical inference tasks with language or programming toolboxes such as R, Python, Mathematica or MATLAB, and Design Expert to summarise analysis and interpretation of industry engineering data, and make appropriate conclusions based on such experimental and/or real-life industrial data;
4. construct appropriate graphical displays of data and highlight the roles of such displays in data analysis, particularly the use of statistical software packages;
5. plan and execute experimental programmes to determine the performance of programme-relevant industrial engineering systems, and evaluate the accuracy of the measurements undertaken; and
6. demonstrate mastery of data analytics and statistical concepts by communicating the results of experimental and industry-case investigations, critically reasoned scientific and professional analysis through written and oral presentation.

Course Contents

Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles, etc. Probability. Binomial, poison hyper-geometric, normal distributions, etc. Statistical inference intervals, test hypothesis and significance. Regression and correlation. Introduction to big data analytics and cloud computing applications. Introduction to the R language; R as a calculator; Vectors, matrices, factors, data frames and other R collections. Iteration and looping control structures. Conditionals and other controls. Designing, using and extending functions. The Apply Family. Statistical modelling and inference in R.

GET 306: Renewable Energy Systems and Technology (3 units C: LH 30 PH 45)

Course Learning Outcomes

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

1. Identify the types, uses and advantages of renewable energy in relation to climate change;
2. Design for use the various renewable energy systems;
3. Recognise and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. Appreciate the environmental impact of energy exploitation and utilisation, and pursue the sustainable development of renewable energy for various applications; and

5. Recognise the exploitation, excavation, production, and processing of fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy.

Course Contents

(Pre-requisite –Good academic standing)

Current and potential future energy systems in Nigeria and globally - resources, extraction, concepts in energy conversion systems; parallels and differences in various conversion systems and end-use technologies, with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal). Energy types, storage, transmission and conservation. Analysis of energy mixes within an engineering, economic and social context. Sustainable energy; emphasise sustainability in general and in the overall concept of sustainable development and the link this has with sustainable energy as the fundamental benefit of renewable energy.

Practical Contents

Simple measurement of solar radiation, bomb calorimeter determination of calorific value of fuels and biomass; measurement of the velocity of wind, waves and the energy that abound in them; laboratory production of biogas and determination of energy available in it; simple conversion of solar energy to electricity; trans-esterification of edible oil into biodiesel; simulation of geothermal energy; Geiger-Muller or Scintillation Counters' determination of uranium or thorium energy; simple solid or salt storage of energy; hybrid application of renewable energy.

GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)

Course Learning Outcomes

At the completion of the course, the students are expected to be able:

1. Explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. Explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. Demonstrate the difference between supervised, semi-supervised and unsupervised learning;
4. Demonstrate proficiency in machine learning workflow and how to implement the steps effectively;
5. Explain natural languages, knowledge representation, expert systems and pattern recognition;
6. Describe distributed systems, data and information security and intelligent web technologies;
7. Explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. Explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing.

Course Contents

(Pre-requisite –Good academic standing)

Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms – examples, their variants and applications to solving engineering problems; understanding natural languages; knowledge representation, knowledge elicitation, mathematical and logic foundations of AI; expert systems, automated reasoning and pattern recognition; distributed systems; data and information security; intelligent web technologies; convergent technologies – definition, significance and engineering applications. Neural networks and deep learning. Introduction to python AI libraries.

IMSU-GET 308 Engineering Economics (3 Units C: LH 45)

Course Learning Outcomes

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

1. Determine an equilibrium and predict changes in an equilibrium in response to market changes
2. Compare and contrast economic profits with accounting profits
3. Identify five economic indicators and utilize them to articulate the state of the economy and prescribe monetary and fiscal policy
4. Conduct and interpret a cost-benefit analysis for an engineering
5. Compare the life cycle cost of two multiple projects using present worth, annual cost, payback and break-even analysis
6. Make a quantitative decision between alternate facilities or systems using Benefit/Cost Ratio
7. Evaluate the feasibility of a project or system by estimating cash demands as a function of time and comparing these with estimated cash flows from available funding source
8. Compute the depreciation of an asset using standard depreciation
9. Communicate the results of an economic modeling process to management and other non - specialist in an informative and professional

Course Contents

(Pre-requisite –Good academic standing)

Valuation. Depreciation accounting: Taxes. Equipment replacements based on deterioration and obsolesce. Dynamic equipment policy. MAPI formula. Break even analysis. Minimum cost points. Analysis based on risk and uncertainty. Introduction to micro-economics: Theory of consumer behavior, theory of demand and supply, market equilibrium, elasticities and behaviour (perfect competition, monopolistic, monopoly and oligopoly), Theory of the firm. Production functions. Introduction to macroeconomics; Level of Investment. Stocks and flows. Investment functions. Economic dynamics.

GET 399: Students Industrial Work Experience II (4 Units C: 12 weeks)

Course Learning Outcomes

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

1. Demonstrate proficiency in at least any three softwares in their chosen career choices;
2. Demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. Carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;
4. Demonstrate proficiency in generating data from laboratory analysis and develop empirical models;

5. Demonstrate proficiency in how to write engineering reports from lab work; 6. fill logbooks of all experience gained in their chosen careers; and
7. Write a general report at the end of the training.

The experience is to be graded and the students must pass all the modules of the attachment and shall form part of CGPA.

Course Contents

(Pre-requisite –Good academic standing)

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (Students are to proceed on three months of work experience i.e. 12 weeks during the long vacation following 300 level). Students are engaged in the more advanced workshops, indoor software design training similar to what they will use in the industry and outdoor construction activities to sharpen their skills. The use of relevant animation videos that mimic industrial scenarios is encouraged. Students are to write a report at the end of the training. As much as possible, students should be assisted and encouraged to secure 3 months' placement in the industry. Examples of outline of activities and experiences to which students are expected to be exposed to earn prescribed credits include:

Section A: Welding and fabrication processes, automobile repairs, · lathe machine operations: machining and turning of simple machine elements, such as screw threads, bolts, gears, etc. Simple milling machine operations, machine tool maintenance and troubleshooting, andwooden furniture making processes.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solid Works drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; autoCAD mechanical, SPSS.

A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project.

Examples of projects should include the following:

a. design of machine components;
b. product design and innovation;
c. part modelling and drafting in solid works; and
d. technical report writing.

IMSU-GET 481 Computer Aided Design and Manufacturing (1 Unit C: LH 15 PH 15)

Course Learning Outcomes

Upon successful completion of this course, the student should be able to:

1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. Use the techniques, skills, and modern engineering tools necessary for engineering practice
3. Analyse system designs using application software.
4. Realise designs within short period of time
5. Integrate computers into manufacturing processes.

6. List and explain CAD software
7. Program Robots

Course Contents

(Pre-requisite –GET 211 and Good academic standing)

Review of computer hardware and software. CAD fundamentals: Modelling, application of CAD models, functions of CAD systems. Role of CAD in Engineering. CAD software and applications: AutoCAD, ArchiCAD, CivilCAD, Electronic workbench, Proteus, CorelDraw etc. Algorithms and software. System designs and analysis using MATLAB and Programming in C, C++. Computer integrated manufacturing (CIM) and flexible design and manufacturing system: CIM objectives, CIM systems, benefits. Barriers to CIM adoption. Computer controlled machines. Numerical control process. Applications and economics of NC. Computer Numerical control. Computer Aided Manufacturing (CAM): CAM system, design and manufacturing interface. Application of computers in planning and control in manufacturing. Types and sources of data used in manufacturing. Manufacturing automation. CAM implementation. Robots: Definition, characteristics of Robots, basic elements and types of Robots. Robot programming, operating methods and application. Introduction to geometric modelling, properties and representation of solids. Interactive computer graphics.

IMSU-GET 493 Engineering Research Methods (1 Units C: LH 15)

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Describe and explain key research concepts, issues, types of research and the systematic process of research gap identification and documentation and use contexts;
2. Search for, assembling and critically analysing research articles, papers and reports and general literature;
3. Formulate and evaluate research objectives, questions and hypotheses;
4. Developing a research proposal or industry project plan;
5. Identify and develop appropriate data acquisition and analysis methods and instrument;
6. Design/structure and lead the research process using appropriate research designs;
7. Use appropriate tools/techniques, including computer soft- and hardware /technologies to interpret, discuss and report/present the result and conclusions derived from research data analysis in oral or written form; and
8. Prepare/format/package research results/output for academic, journal articles, technical and other reports and exhibitions/fairs (scientific, trade, etc.) as an individual or team/work group.

Course Contents

(Pre-requisite –Good academic standing)

Origins and definitions of research. Problem identification and formulation. Research types/design. Qualitative, quantitative and mixed methods of research. Measurement. Experiments. Sampling. Data collection. Data presentation. Data analysis. Interpretation of data and technical report writing. Use of encyclopedia, research guides, handbooks, academic databases for engineering disciplines. Use of tools/techniques for research production: referencing and citation formats/styles and software. Research management and reporting best practices. Plagiarism definitions, types, detection software. Basics of document analysis, systematic review and management methods. Practical documentation/presentation projects/seminars.

GET 499: Students Industrial Work Experience III (8 Units C: 24 weeks)

Course Learning Outcomes

Students on Industrial Work Experience Scheme (SIWES) are expected to:

1. Be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. Bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods, and ways of safeguarding the work environment – human and materials;
3. Experience/simulate the transition phase of students from school to the world of work and the environment seamlessly, and expose them to contacts for eventual job placements after graduation;
4. Be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. Exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Contents

(Pre-requisite –GET 299, GET 399)

On the job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc, for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment. Also, there will be a comprehensive report covering the whole of the student's industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

GET 501: Engineering Project Management (3 Units C: LH 45)

Course Learning Outcomes

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

1. Explain the basics of project management as it relates to the Engineering discipline;
2. Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to their own work, as a member and/or leader in a team, to manage projects and in multi-disciplinary environments;
3. Conduct, manage and execute projects in multi-disciplinary areas;
4. Possess the skills needed for project management; and
5. Work within the budget when executing a project for proper management.

Course Contents

(Pre-requisite –Good academic standing)

Project management fundamentals – definitions, project environment, nature and characteristics, development practice, management by objectives, and the centrality of engineering to projects, infrastructures, national and global development. The scope of project management – organisational,

financial, planning and control, personnel management, labour and public relations, wages and salary administration and resource management. Identification of project stakeholders; beneficiaries and impacted persons – functions, roles, responsibilities. Project community relations, communication and change management. Project planning, control and timeliness; decision making, forecasting, scheduling, work breakdown structure (WBS), deliverables and timelines, logical frameworks (log frames), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case - financial, technical and sustainability considerations.

Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

GET 502: Engineering Law (2 Units C: LH 30)

Course Learning Outcomes

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

1. Describe and explain the basic concept, sources and aspects of law;
2. Describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. Describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and
4. Develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop, and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course Contents

(Pre-requisite –Good academic standing)

Common Law: its history, definition, nature and division. Legislation, codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: Forms of contract and criteria for selecting contractors; offer, acceptance, communication termination of contract. Terms of Contracts; suppliers' duties – Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risk. Health and Safety. Duties of employers towards their employees. Duties imposed on employees. Fire precautions act. Design for safety. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

10.4.3 Departmental Coded Courses

EEE 102: Introduction to Electrical and Electronic Engineering (2 Units C: LH 15)

Learning Outcomes

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

1. comprehend the duties and functions of an Electrical and Electronics Engineer (EEE);
2. state the requirements for the profession and career opportunities; 3. state the careers related to EEE; and 4. explain the future of EEE.

Course Contents

History of Electrical Engineering. Evolution of EEE. Duties of EE Engineers. Areas of specialisation and work environment. Skill requirements (soft and hard). Qualities for EE Engineers. Careers related to EEE. Typical course modules. Job outlook/opportunities for EE Engineers. Future of EEE. Professional registration (NSE, COREN, IEEE, IET, etc.). Passive components (R, L, C, transformers): descriptive features, including values and colour codes, uses in electrical circuits. DC and AC signal parameters

EEE 202: Applied Electricity II (3 Units C: LH 45)

Learning outcomes

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

1. differentiate between various d.c. and a.c. machines;
2. explain the principles of operation of machines;
3. explain the operation of basic semiconductor devices and their basic applications; and
4. explain the principle of operation of communication systems with examples.

Course contents

Basic machines – DC, synchronous alternators, transformers, equivalent circuits. Three- phase balanced circuits, PN junction diode, BJTs, FETs, thyristors, communications fundamentals, introduction of TV, Radio, Telephone systems.

IMSU-EEE 305: Control Systems (2 Units C: LH 30)

Course Learning Outcomes

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

1. state examples of simple control systems;
2. state and explain different stability criteria and compensation methods for linear control systems; and
3. discuss non-linear control systems and their characteristics.

Course Contents

Basic concepts and examples of control systems; Feedback, Time response analysis, concept of stability, Routh-Hurwitz criterion; Root-locus techniques, Frequency-response analysis, Polar and Bode plots, Nyquist stability criteria. Nichol's chart, compensation techniques; introduction to non-linear systems.

IMSU-EEE 311: Circuit Theory (2 Units C: LH 30)

Learning outcomes

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

1. write circuit equations for a coupled-inductor system;
2. analyse circuits containing ideal transformers and autotransformers;

3. analyse three-phase wye- and delta-connected balanced circuits;
4. plot Bode diagrams from transfer functions for SISO circuits;
5. write behavioural descriptive equations for series- and parallel-resonant circuits in the time- and frequency domains;
6. use Fourier series techniques to analyse circuit responses to periodic signals; and
7. derive two-port parameters of circuits.
8. state, explain and apply circuit theorems to d.c. circuits;
9. obtain the network response to certain input signals using phasor notations and diagrams;
10. state and apply Laplace transforms to solve passive circuits;
11. analyse non-linear circuits using approximation methods;
12. state the conditions for realisability of transfer functions;
13. design/synthesize RL, RC, LC and RLC circuits from given transfer functions; and
14. design passive and active filters from transfer functions and performance specifications.

Course Contents

Passive circuit elements: R, L, C, transformers; circuit theorems: Ohm's, KVL, KCL, loop current, node potential, superposition. Network response to step, ramp and impulses. Network functions: response to exponential, sinusoidal sources.

Three-phase balanced circuits and power; mutual inductance; Linear transformer, ideal transformer, autotransformer; Frequency response, transfer function, Bode plots; Series and parallel resonance in the frequency domain; Series and parallel resonance in the time domain; Fourier series in circuit analysis; Two-port analysis parameters; Laplace transform circuit analysis transfer functions: pole-zero configuration and application in solving circuits, resonance;

Non-linear circuit analysis. Network functions, Locus diagrams. Circuit synthesis: realisability criteria, Foster and Cauer syntheses of RC, RL, LC and RLC circuits. Filters: design, operation, low, high, bandpass. Butterworth and Chebychev filter design. Active network analysis and synthesis.

IMSU-EEE 343: Principles of Power Systems and Electrical Machines(2 Units C: LH 30)

Learning Outcomes

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

1. recognise the structure and operation of electricity generation, transmission and distribution systems and the impact on the society and environment;
2. solve problems involving modeling, design and performance evaluation of power transmission lines;
3. analyse power flow in power transmission networks and apply power flow results to solve simple planning problems;
4. calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings; and
5. analyse the transient stability of simple power systems using equal area criterion.
6. explain operating principles of fundamental components of Electric Machines: motors, generators and transformers including synchronous, asynchronous, DC and special purpose motors, AC, DC generators and autotransformers, CTs, PTs, step-up and stepdown transformers;
7. examine the magnetic field, reluctance of magnetic materials, flux and mmf in magnetic circuits and perform transformer analysis using standard testing procedures including open-circuit and short-circuit tests, voltage regulation, efficiency and circuit analysis involving transformers;

8. examine construction, working principles, characteristics and equivalent circuit of three phase synchronous generators, synchronous motors and induction motors, single phase induction and special purpose motors; and
9. analyse voltage-current characteristics, commutation of DC generators, torque speed characteristics and speed regulation of DC motors.

Course Contents

Generation of electric energy: Sources of energy. Heat value of fuels. Thermal stations. Hydroelectric stations. Nuclear stations.

Economics of power supply: Fixed and running charges in electric power production. Load curves and load duration curves including concept of base, intermediate and peak load. Definition of load factor, maximum demand, Diversity factor and their effects on generation. Distribution system: Survey of power system components: feeders, distributors, services mains, radial and ring-man systems. Voltage drop in distribution systems. Per-unit qualities. Overhead transmission system: Conductors and insulators. Transmission line parameters. Resistance, inductance and capacitance. Skin effect. Corona discharge. Stringing: Calculation of sag and tension. Stringing chart and performance. Representation of short and long power lines. Underground cables: Types. Inductance of concentric cables. Capacitance of single-core and three-core cables. Thermal characteristics. Sheath currents.

Circuit breakers: Principles of arc-extinction. Types of circuit breakers. Current growth in a purely inductive circuit. Interpretation of circuit breakers lest oscillographs. Current chopping. Resistance and capacitance switching. Breaking and making currents. DC Machines Basics: Introduction to Machinery Principles, Rotational motion, Newton's Law and power relationships, Magnetic field and magnetic circuit with air gap, Faraday's law, Production of induced force on wire, Induced voltage on a conductor moving in a magnetic field, Linear DC machine. DC Machinery Fundamentals: Simple rotating loop between curved pole faces, Commutation (basic introduction), Construction and simple armature winding, Internal generated voltage and induced torque equations of real machines. DC Generators: Introduction and working principle, Characteristics of separately excited, shunt, series, and compounded generators. DC Motors Basic: Introduction and working principle, Characteristics of separately excited, shunt, series, and compound motors, Stepper motor and simple drive circuit.

AC Machines Fundamentals: Transformer fundamentals: importance, types, and construction, The ideal transformer and theory of operation of single-phase transformer, Phasor diagram (basic level), Review of three-phase generation, Proof of rotating magnetic field concept, Relationship between poles, speed, and frequency. Three-Phase Induction Motor (Basic): Construction and working principle, Synchronous speed and slip concepts, Basic torque–speed characteristics.

Single-Phase and Special Purpose Motors (Basic): Universal motor, Single-phase induction motor (introduction and starting methods), Split-phase and capacitor start motors, Shaded pole motor.

IMSU-EEE 355: Digital, Analogue and Applied Electronics (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. Classify, describe and discuss the various logic gates and flip-flops and multivibrators; and
2. Design simple logic and sequential circuits using logic gates and flip-flops.

3. Classify, describe and discuss the principles of operation and applications of FET and BJT; and
4. Calculate amplifier parameters; and design simple amplifiers using BJT and FET with given specifications.
5. Explain the principles of feedback and negative resistance in oscillator circuits.
6. Analyze and design different types of oscillators (Wien-bridge, Hartley, Colpitts, and Crystal) and evaluate their conditions for oscillation and frequency stability.
7. Differentiate between various types of multivibrators (bistable, astable, and monostable), clocked flip-flops, and Schmitt triggers.
8. Apply multivibrators in practical applications such as memory devices, clocks, counters, and shift registers.
9. Describe the structure, fabrication, and packaging techniques of integrated circuits including planar, hybrid, thin-film, thick-film, and printed circuits.
10. Evaluate the properties and applications of typical linear and digital ICs in electronic systems.
11. Perform analysis and design using operational amplifiers for linear and non-linear applications.
12. Explain the theory of operation and characteristics of thyristor family devices such as SCRs, triacs, and diacs.
13. Design and implement circuits using thyristors for control and switching applications.

Course contents

Number Systems and Codes. Logic Gate Simplification of Logic expressions using Boolean algebra. Simplification of Logic expressions using Karnaugh Method. Design of combinational circuit. Flip-Flops. Application of Flip-Flops in the design of counter. Registers and timers. Switching and wave shaping circuits. Generation of non-sinusoidal signal (Multivibrators). Introduction to ADC and DAC. Design of Logic Gates (Diode, DTL, TTL, ECL etc). Sequential circuits. Introduction to microprocessors.

Single-stage transistor amplifiers using BJT and FET Equivalent circuits and calculation of current gain, voltage gain, power gain, input and output impedance. Operational Amplifiers: Description, parameters and applications. Feedback, broadband and narrowband amplifiers. Power amplifiers. Voltage and current stabilizing circuits. Voltage amplifiers, multi-stage amplifiers using BJTs and FETs.

Oscillators: Feedback principles and circuits; feedback and negative resistance. Oscillators; phase shit Wien-bridge, Hartley, Colpitts and Crystal Oscillators; conditions for Oscillation; Frequency Stability; Multivibrators: Bistable, Astable and Monostable; Clocked flip-flops and Schmitt trigger; Applications of multivibrators as memory devices, clocks, counters (up/down), and shift registers, Integrated Circuits: planner structure and Hybrid ICs, thin film and thick film circuits: printed circuits design and fabrication; typical linear and Digital ICs their properties applications; assembly and packaging considerations.

Operational amplifiers: Analysis and design Thyristor: Silicon controlled rectifiers (SCRs), triacs and diacs – the theory of operation and characteristics; applications.

IMSU-EEE 372: Communication Principles (2 Units C: LH 45)

Learning Outcomes

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

1. analyse communication systems in both the time and frequency domains;
2. describe the principles of amplitude modulated and angle modulated communication systems, and be able to analyse their performance in the presence of noise;
3. explain source coding and its relations to information theory, citing Shannon's theorem;
4. describe the principles of various digital modulation systems and their properties, including bandwidth, channel capacity, transmission over bandlimited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise; and
5. explain engineering fundamentals of photogeneration, photodetection and lightwave propagation for optical communications.

Course Contents

Models of telecommunication system. The concept of information volume. Characteristics of analogue audio and video signals. Analogue modulation techniques and their implementation: amplitude and angle modulation, Frequency Division Multiplexing. Digitization of analogue signals. Binary system. Arithmetic operations on binary numbers. Modulo 2 arithmetic. Pulse code modulation (PCM), sampling, quantization, coding. Delta and differential pulse code modulation. Synchronous and asynchronous, static and dynamic time division multiplexing. Plesio-synchronous digital hierarchy, primary group, secondary group, groups of higher levels. Synchronous digital hierarchy. Multiplexing PDH signals into SDH STM-1 transport module. Transmission media. Optical fibres: single mode, multimode. Optical cables. Wavelength division multiplexing (WDM): Dense wavelength division multiplexing (DWDM)

IMSU-EEE 374: Electrical and Electronic Engineering Lab (1 Unit C: PH 45)

Electronics & Telecommunications

1. Familiarization with electronic and telecommunications lab instruments /equipment (oscilloscope, signal generator, spectrum analyzer, power supply, Multimeter).
2. Characteristics of semiconductor diodes (forward and reverse bias).
3. Rectifier circuits: half-wave, full-wave, and bridge rectifiers with/without filters.
4. Characteristics of a BJT transistor (CE configuration).
5. Transistor as an amplifier (small-signal CE amplifier).
6. Transistor as a switch.
7. Operational amplifier applications: Inverting & non-inverting amplifiers, Summing amplifier, Integrator and differentiator
8. Oscillator circuits: RC phase-shift or Wien bridge oscillator.
9. Verification of truth tables for basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR).
10. Implementation of Boolean expressions using universal gates (NAND/NOR).
11. Study of combinational circuits: half adder, full adder, and multiplexer.
12. Study of sequential circuits: flip-flops (RS, JK, D, T).
13. Counters: asynchronous (ripple) and synchronous counters.
14. Shift registers: serial-in serial-out (SISO), serial-in parallel-out (SIPO).
15. Design and construction of simple domestic and industrial products with emphasis on modularity and use of manufacturer's data books. PCB design and fabrication.

Communcation Systems

1. Time-domain and frequency-domain analysis of signals using oscilloscope and spectrum analyzer.
2. Amplitude Modulation (AM): Generation of AM signal, Demodulation (envelope detector, synchronous detector)
3. Frequency Modulation (FM): Generation of FM signal, Demodulation (discriminator method)
4. Pulse Modulation: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM)
5. Digital Baseband Transmission: Line coding (NRZ, RZ, Manchester) and spectrum analysis.
6. Pulse Code Modulation (PCM): sampling, quantization, and encoding.
7. Delta Modulation and Adaptive Delta Modulation.
8. Noise analysis: Effect of noise on AM and FM reception.
9. Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM).
10. British/Nigerian regulations for the electrical equipment of buildings, electricity supply regulations and electricity safety rules.

Power & Machines

1. Laboratory safety induction – rules, precautions, and familiarization with electrical machines lab equipment.
2. Study of single-phase transformer – open circuit and short circuit tests.
3. Determination of efficiency and voltage regulation of a single-phase transformer.
4. Load test on a single-phase transformer.
5. Load test on a DC shunt motor – speed-torque characteristics.
6. Load test on a DC shunt generator – voltage-current characteristics.
7. No-load and blocked-rotor test on a three-phase induction motor.
8. Load test on a three-phase induction motor – performance characteristics.
9. Measurement of three-phase power using two-wattmeter method.
10. Study of single-phase and three-phase energy meters.
11. Speed control of a DC motor (armature and field control methods).

IMSU-PBL 300: Problem Based Learning I (2 Units C: PH 90)

Course Learning Outcomes (CLOs)

By the end of the exercise, students will be able to:

1. **Identify and define problems** within real-life or simulated scenarios, demonstrating critical thinking and analytical skills.
2. **Apply interdisciplinary knowledge** to explore and evaluate possible solutions to complex, open-ended problems.
3. **Develop problem-solving strategies** by generating, testing, and refining alternative solutions.
4. **Work collaboratively in teams**, demonstrating effective communication, leadership, and interpersonal skills.
5. **Manage learning independently** by identifying knowledge gaps, researching relevant information, and applying self-directed learning techniques.
6. **Integrate theory with practice** in formulating feasible and innovative solutions.

7. **Evaluate outcomes critically**, assessing both the process and results of problem-solving activities.
8. **Present findings effectively** through oral, written, and digital communication, tailored to academic, professional, or community contexts.
9. **Reflect on personal and group learning processes**, identifying strengths, weaknesses, and strategies for continuous improvement.
10. **Demonstrate ethical reasoning and professional responsibility** in addressing societal, technical, or organizational problems.

Course Contents for PBL I

(Pre-requisite- Good Academic Standing)
Introduction to PBL: Concept, history, and philosophy of PBL; Differences between PBL and traditional learning approaches; Roles of students and facilitators in PBL; Expected outcomes of PBL.

Problem Formulation: Identifying and defining real-world problems; Structuring open-ended problems; Characteristics of effective problems; Problem analysis techniques (e.g., brainstorming, mind mapping).

Collaborative Learning and Teamwork: Group formation and dynamics; Team roles and responsibilities; Conflict resolution and consensus building; Effective communication and collaboration.

Self-Directed Learning: Information literacy: searching, evaluating, and synthesizing knowledge; Critical thinking and inquiry-based approaches; Independent and guided research skills; Time and resource management in problem-solving.

Problem-Solving and Decision-Making Skills: Analytical and creative thinking techniques; Systems thinking and modeling approaches; Evidence-based reasoning; Decision-making under uncertainty.

Application of PBL in Disciplines: Case studies from engineering, medicine, business, and social sciences; Interdisciplinary problem scenarios; Community-based projects.

Assessment in PBL: Formative and summative assessment in PBL; Peer and self-assessment techniques; Reflective journals, portfolios, and presentations; Rubrics for evaluating teamwork, creativity, and problem-solving.

Reflection and Lifelong Learning: Metacognition and self-evaluation; Continuous improvement through reflection; Transfer of PBL skills to professional practice; Building lifelong learning habits.

Practical Component: Capstone Project / Problem Challenge: Students work on a complex, real-world problem in teams and present solutions (report, prototype, or presentation).

IMSU-EEE 405: Electromagnetic Fields and Waves (2 Units C: LH 30)
Learning Outcomes

Students will be able to:

1. state and explain the various electromagnetic laws;
2. derive and explain Maxwell's equation in rectangular coordinates; and

3. explain wave propagation mechanism in conductors and unbounded dielectric media.

Course Contents

Review of electromagnetic laws in integral form, Gauss's Law, Ampere's and Faraday's Laws. Electrostatic fields due to distribution of charge. Magnetic fields in and around current carrying conductors. Time-varying magnetic and electric fields. Conduction and displacement current. Maxwell's equations (in rectangular co-ordinates and vector-calculus notation). Derivation of Maxwell's equations, electromagnetic potential and waves. Poynting vector, boundary conditions. Wave propagation in good conductors, skin effect; plane waves in unbounded dielectric media.

IMSU-EEE431: Microprocessors, Microcontrollers and Embedded Systems Design and Programming (2 Units C: LH 45)

Learning Outcomes

Upon the successful completion of the course, students will be able to:

1. develop an ALP in 8085 microprocessor using the internal organisation for the given specification;
2. describe the architecture and functional block of 8051 microcontrollers;
3. develop an embedded C and ALP in 8051 microcontroller using the internal functional blocks for the given specification;
4. explain various peripheral devices such as 8255, 8279, 8251, 8253,8259 and 8237; and
5. explain microcontroller application and basic architecture of PIC, ARM and ATMEGA processors.
6. analyse and explain the basic building blocks of embedded systems hardware;
7. identify relevant components and building blocks for embedded solutions;
8. evaluate different embedded system architectures;
9. describe the hardware and software architecture of processors used in embedded systems (2);
10. use embedded system development platforms and environments;
11. specify relevant embedded systems requirements such as memory, processor speed and energy consumption;
12. develop experience in assembly, C++, C, Python programming languages (5); and
13. build embedded system solutions with the help of common hardware interface units
14. **Describe** the architecture, features, and applications of microcontrollers.
15. **Differentiate** between microprocessors and microcontrollers in terms of design
16. **Write and debug** assembly and C programs to execute basic computational and control tasks.
17. **Interface** microcontrollers with peripheral devices (LEDs, switches, sensors, motors, displays) for real-world applications

Course Contents

Introduction to microcomputers and embedded systems: Processor architectures; Introduction to Microcontrollers: Overview of microprocessors vs. microcontrollers, Applications of microcontrollers in embedded systems, Microcontroller families (8051, PIC, ARM, AVR, Arduino, etc.). Microcontroller architecture. Interfacing and Peripherals: Interfacing digital input/output devices (LEDs, switches, 7-segment displays), Interfacing analog devices (ADC, DAC, sensors), Serial communication: UART, SPI, I²CLCD and keypad interfacing, Motor control (stepper and DC motors). Applications of Microcontrollers: Real-time control applications, Data acquisition systems,

Embedded system design case studies (home automation, robotics, IoT basics). microcontrollers used in embedded systems; CPU, memory and input output units; Interrupts;
A basic microprocessor system: the CPU, memory, I/O, and buses subsystems, basic operation of a microprocessor system: fetch and execute cycle, the architecture of some typical 8-bit, 16-bit microprocessors (INTEL, MOTOROLA) and their features; programming model in real mode: registers, memory, addressing modes; organisation of the interrupt system, interrupt vectors, and external interrupts, implementation of single and multiple interrupts in real mode; programming model in protected mode: registers, memory management and address translation, descriptor and page tables, system control instructions, multitasking and memory protection, addressing modes, and interrupt system; memory interfacing and address decoding; I/O interfacing: memory mapped i/o, isolated i/o, bus timing, i/o instructions; peripheral devices interfacing: 8255 PPI/6821 PIA, 8251 USART/6821 UART, DMA, Timer/Counter chips, etc; instruction set; assembly language Programming of INTEL and MOTOROLA microprocessors; and discussion of a typical system e.g. IBM PC, Apple Macintosh.
Introduction to hardware level programming of embedded systems: Programming in assembler, Programming in C, / C++/, Python, etc. Development platforms for embedded software; Introduction to microcomputer interfaces: Digital I/O, Serial I/O, Timers, Analog to-digital conversion, Pulse Width Modulation (PWM)

IMSU-EEE 441 : Power Systems Engineering (2 Units C: LH 30)

Learning Outcomes

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

1. apply the knowledge of mathematics, and engineering to the analysis of electrical machines and transmission lines;
2. design and conduct experiments, as well as analyse and interpret data;
3. identify, formulate, and solve engineering problems in the area of electromechanical energy conversion devices;
4. understand and apply some knowledge of contemporary issues concerning Electrical/Energy systems; and
5. use techniques, skills, and modem engineering tools necessary for engineering practice.

Course Contents

Basic single-phase modeling. Three phase system analysis. Three phase models of transmission lines. Three phase models of transformers. Formation of the system admittance matrix. Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission. Load Flow: Introduction, Basic nodalmethod. Conditioning of Y matrix. The case where one voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Me Basic single-phase modeling. Three-phase system analysis. Three-phase models of transmission lines. Three-phase models of transformers. Formation of the system admittance matrix. Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission. Load Flow: Introduction, Basic nodal-method. Conditioning of Y matrix. The case where one voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Method competitive in load flow. Characteristics of the Newton-Raphson load flow method. Decoupled Newton load flow method. Fast Decoupled load flow. Convergence criteria and tests. Numerical examples. AC-DC Load Flow: Introduction. Formulation of the problem. DC system model. Solution techniques. Control of converter AC

terminal voltage. Extension to multiple and or multi-terminal DC systems. DC convergence tolerance. Test system and results Numerical examples. Optimal operating strategies: Scheduling of generation, types generating stations and their tecno-economic operating characteristics Fault analysis and Control strategy: types of system protection, generators, transformers, lines etc protection schemes switchgear and circuit breakers operating principles and types.

IMSU-EEE 445: Electrical Machines (2 Units C: LH 45)

Learning Outcomes

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

1. examine the magnetic field, reluctance of magnetic materials, flux and mmf in magnetic circuits and perform transformer analysis using standard testing procedures including open-circuit and short-circuit tests, voltage regulation, efficiency and circuit analysis involving transformers;
2. examine construction, working principles, characteristics and equivalent circuit of three phase synchronous generators, synchronous motors and induction motors, single phase induction and special purpose motors; and
3. analyse voltage-current characteristics, commutation of DC generators, torque speed characteristics and speed regulation of DC motors.

Course Contents

DC Machinery: Armature reaction, interpoles, compensating winding, and brush shifting, Magnetization curve and voltage regulation, Equivalent circuits of DC machines, Parallel operation of DC generators, Speed regulation of DC motors, Torque–speed equations and efficiency calculations. Transformers: Leakage reactance and equivalent circuit of real transformer, No-load and short-circuit tests, Losses and efficiency, Voltage regulation and per-unit system, Autotransformers (construction, rating, and advantages), Current Transformer (CT) and Potential Transformer (PT), Three-phase transformers: construction, connections (Y–Y, Δ–Δ, Δ–Y), harmonics suppression, vector groups, Two-transformer three-phase bank, Transformer inrush current, Transformer ratings and related numerical problems.

Synchronous Machines: Synchronous generator: construction, excitation system, Equivalent circuit and phasor diagram, Power and torque equations, Effect of load changes, parallel operation of generators, Measurement of machine parameters, Synchronous motor: principle, equivalent circuit, phasor diagram, Torque–speed characteristics, power factor correction (V-curves), Effects of load and field current changes, Starting of synchronous motor, ratings.

Three-Phase Induction Motor: Equivalent circuit derivation, Power and torque equations. Detailed torque–speed characteristics, Losses, efficiency, and power factor.

Special Purpose Motors: Permanent split capacitor motor, Capacitor start and capacitor run motors, Reluctance motors, Hysteresis motor.

IMSU-EEE 447: Power Systems and Machine Laboratory (1 Units C: PH 45)

Learning Outcomes

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

1. **Demonstrate understanding of power system equipment** by identifying, describing, and analyzing the design features, construction, and installation practices of transformers, machines, protection systems, and distribution center components.
2. **Apply practical knowledge of circuit theory** to analyze polyphase circuits, transmission line parameters (inductance, skin effect), and voltage-current relationships.
3. **Model and represent power system components** using equivalent circuits, generalized circuit constants, and circle diagrams, applying matrix algebra where necessary.
4. **Formulate and solve the power system load flow problem** using digital computer-based techniques such as Gauss-Seidel, Newton-Raphson, second-order methods, Hessian, and fast-decoupled methods.
5. **Implement computational efficiency methods** by applying sparsity techniques and optimal ordering in large-scale power system problem solving.
6. **Apply stochastic methods** to perform probabilistic load flow studies and evaluate their practical applications in uncertain operating conditions.
7. **Conduct fault analysis using digital tools**, interpret results, and recommend suitable protective measures.
8. **Analyze and assess power system stability** under various operating scenarios, and apply appropriate solution techniques for maintaining stable operation.
9. **Integrate digital computation tools and simulation software** to model, analyze, and solve real-world power system operation and planning problems.

Course Contents

Design features and Construction of simple power system equipment. Study of common equipment of power system distribution centres and installation practices, earthing, protection, transformers, machines and apparatus. Polyphase circuits. Inductance and skin effect. Current and voltage relations in a transmission line. Generalized circuit constants, circle diagrams application of Matrix algebra to power system circulation. Modelling of power system components. Formulation of the load flow problem for digital computer solutions; methods of solution using DC, Newton Raphson, Second Order, Gauss-Seidel, Hessian and the fast decoupled techniques. Sparsity techniques and optimal orderling methods. Stochastic Load flows and applications. Fault Analysis using the digital computer. Power Systems Stability Analysis and Solutions techniques.

EEE 451: Power Electronics (2 Units C: LH 30)

Learning Outcomes:

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

1. understand the principles of power control by switching; demonstrate the benefits of switched mode circuits; be familiarised with the commonly used semiconductor switching devices;
2. demonstrate a full understanding on several DC-DC converters; perform analysis on their operation principles; develop design equations for selecting their components;
3. be able to explain how the steady-state AC voltage and current are related to each other in power circuits using phasor analysis;
4. understand and be able to quantify active, reactive and apparent power;
5. comprehend the operation principles for several thyristors-based rectifiers; quantify the current harmonics and the average power drawn by a rectifier; and

6. understand the H-bridge based inverters and their several control methods; develop the skills in analysing the different modes of operations for the inverters; gain the understanding on how the power is delivered or absorbed by grid-connected inverters.

Course Contents

The basics of three-phase circuits, connections, voltage and current analysis and real and reactive power calculations; the fundamentals of electricity conversion from the form supplied by the source to the forms required by the load; power electronic conversion techniques, including the basic converters (DC-DC, AC-DC and DC-AC) and their power switching and control methods; the methods of circuit analysis applicable to switched mode circuits; essential properties of the relevant semiconductor devices; simple converters for practical applications. Characteristics of power devices; DC-DC converters; AC Current, Voltage and Power; AC-DC converters and Inverters (DC-AC converters).

IMSU-EEE 459: Electronic and Computer Engineering Laboratory (1 Unit C: PH 45)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Demonstrate safe laboratory practices** in handling electrical/electronic equipment and components.
2. **Perform accurate measurements** of electrical parameters using standard laboratory instruments.
3. **Analyze and construct analog electronic circuits** such as rectifiers, amplifiers, and operational amplifier applications.
4. **Design and test digital logic circuits** using combinational and sequential building blocks.
5. **Program microcontrollers and microprocessors** for simple interfacing and control applications.
6. **Assemble and configure computer hardware and networks** for engineering applications.
7. **Integrate sensors, actuators, and controllers** into simple measurement and control systems.
8. **Document laboratory experiments and present findings** in clear, concise technical reports.
9. **Work effectively in teams** to design and implement mini-projects that combine electronics and computer engineering principles.

Course Contents

Basic Electrical & Electronic Measurements: Laboratory safety procedures and regulations, Use of basic test equipment: multimeter, oscilloscope, function generator, power supply, Measurement of voltage, current, resistance, and power. Verification of Ohm's law, KCL, and KVL. Analog Electronics Laboratory: Characteristics of diodes and applications (rectifiers, clippers, clampers), Transistor characteristics (BJT and MOSFET). Amplifier circuits: common emitter/source, frequency response. Operational amplifiers: inverting, non-inverting, summing, differential, and integrator circuits. Digital Electronics Laboratory: Logic gates and verification of truth tables. Combinational logic design (adders, multiplexers, encoders/decoders). Sequential logic design (latches, flip-flops, counters, registers). Introduction to digital system design with HDL (optional). Microprocessor and Microcontroller Laboratory: Introduction to microcontrollers (e.g., Arduino, PIC, or ARM). Writing,

uploading, and debugging simple programs. Interfacing LEDs, switches, and sensors. Serial communication (UART, SPI, I²C). Computer Engineering Laboratory: Computer hardware identification and assembly. Introduction to operating systems installation and configuration. Basic networking setup (IP addressing, routers, switches). Introduction to programming for embedded systems (C/Python). Control & Instrumentation Experiments: Measurement of physical quantities (temperature, displacement, light) with sensors. Interfacing sensors with microcontrollers. Simple closed-loop control experiments (motor speed control, temperature control).
Project and Report Writing: Mini-project design integrating electronics and computing principles. Technical report writing and presentation skills.

IMSU-EEE 461: Process Control, Measurement and Instrumentation (2 Units C: LH 30)

Course Learning Outcomes (CLOs)

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

1. **Explain** the principles of process control, measurement, and instrumentation, including variables, system components, and control strategies.
2. **Analyze** the static and dynamic characteristics of measurement systems and evaluate sources of errors.
3. **Identify, select, and apply** suitable sensors, transducers, and actuators for industrial process measurement and control.
4. **Develop mathematical models** of physical and chemical processes and analyze their dynamic behavior.
5. **Design and tune controllers** (P, PI, PID) to achieve desired performance in process systems.
6. **Evaluate the stability** of control systems using analytical and graphical techniques.
7. **Implement advanced control strategies** (cascade, feedforward, ratio, predictive) in real-world systems.
8. **Use digital tools and simulation software** to model, simulate, and optimize process control and instrumentation systems.
9. **Apply knowledge of measurement and control** to industrial applications such as heat exchangers, reactors, distillation columns, and power systems.
10. **Troubleshoot and propose solutions** for faults in process measurement and control systems.

Course Contents

Introduction: Importance of measurement and control in engineering systems, Basic concepts: process variables (measured, manipulated, controlled, disturbance), Open-loop vs. closed-loop, systems, Block diagrams and signal flow. Fundamentals of Measurement: Principles of measurement systems, Static and dynamic characteristics of instruments (accuracy, precision, sensitivity, response time, linearity, drift), Errors in measurement and calibration methods. Sensors, Transducers, and Signal Conditioning, Sensors and transducers for temperature, pressure, flow, level, displacement, and composition, Signal transmission and conditioning (pneumatic, analog, digital, smart sensors), Amplifiers, filters, and data acquisition systems. Instrumentation Systems: Control valves and actuators, Final control elements and their characteristics, Electronic, pneumatic, and digital controllers, Industrial instrumentation standards. Process Dynamics and Control: Mathematical modeling of mechanical, thermal, fluid, and chemical processes, Linearization and transfer functions,

First- and second-order systems, time delay, and response analysis. Control System Design: Proportional, integral, and derivative (P, PI, PID) control actions, Controller tuning methods (Ziegler–Nichols, Cohen–Coon, trial-and-error), Stability analysis (Routh-Hurwitz, Nyquist, Bode plots, Root Locus). Advanced Control Strategies: Feed forward, cascade, and ratio control, Dead-time compensation (Smith predictor), Adaptive and predictive control (MPC basics), Multivariable (MIMO) control and decoupling. Digital and Computer-Based Control: Discretization and Z-transform methods, Implementation of controllers in digital systems, Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems (DCS). Industrial Applications: Measurement and control of reactors, boilers, heat exchangers, turbines, distillation columns, Case studies of industrial process control failures and solutions.

IMSU-EEE 471: Digital Systems Design with VDHL (2 Unit C: LH 30)

Learning Outcomes

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

1. explain VHDL as a programming language;
2. design the combinational and sequential logic circuits using VHDL;
3. design programmable logic devices (PLDs) and networks of arithmetic operations;
4. gain proficiency with VHDL software package and utilise software package to solve problems on a wide range of digital logic circuits.

Course Contents

Finite state machine: definition, mealy and Moore models, state diagram, state table, transition table; sequential circuits design using flip-flops, asynchronous and synchronous circuit design; algorithm state machine; design examples and exercises; structured design: design constructs, design levels, geometry-based interchange formats, computer-aided electronic system design tools, schematic circuit capture, hardware description languages, design process (simulation, synthesis), structural design decomposition; introduction to VHDL: VHDL language abstractions, design hierarchies, VHDL component, lexical description, VHDL source file, data types, data objects, language statements, concurrent VHDL, sequential VHDL, advanced features of VHDL (library, package and subprogrammes); structural level modelling, register-transfer level modelling, FSM with data path level modelling, algorithmic level modelling; introduction of ASIC, types of ASIC, ASIC design process, standard cell ASIC synthesis, FPGA design paradigm, FPGA synthesis, FPGA/CPLD architectures; VHDL Design: top-down design flow, verification, simulation alternatives, simulation speed, formal verification, recommendations for verification, writing RTL VHDL code for synthesis, top-down design with FPGA; VHDL synthesis, optimisation and mapping, constraints, technology library, delay calculation, synthesis tool, synthesis directives; and computer-aided design of logic circuits.

IMSU-EEE 473: Digital Signal Processing and Applications, System Modeling & Simulation (2 Units C: LH 30)

Learning Outcomes

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

1. understand analytical tools such as fourier transforms, discrete fourier transforms, fast Fourier transforms and Z-transforms required for digital signal processing;
2. get familiarized with various structures of IIR and FIR systems;
3. design and realise various digital filters for digital signal processing; and
4. understand the applications of DSP in speech processing and spectrum analysis.
5. Explain the principles of system modeling and simulation and their role in analyzing complex engineering problems.
6. Classify systems and select appropriate modeling approaches for continuous, discrete, deterministic, and stochastic systems.
7. Develop mathematical models of dynamic systems using differential equations, state-space, and transfer function representations.
8. Implement computer-based simulations using modern tools (e.g., MATLAB/Simulink, Python).
9. Apply discrete-event simulation methods to analyze queuing systems, networks, and resource allocation problems.
10. Verify and validate models to ensure correctness, accuracy, and reliability of simulation results.
11. Interpret simulation results and provide meaningful conclusions for engineering decision-making.
12. Work in teams to design and conduct simulation studies addressing real-world engineering challenges.

Course Contents

Discrete signals and Z-transform, digital fourier transform, fast fourier transform; the approximation problem in network theory; synthesis of low-pass filters; spectral transforms and their application in synthesis of high-pass and band-pass filters; digital filtering, digital transfer function aliasing, one-dimensional recursive and non-recursive filters; computer techniques in filter synthesis, realisation of filters in hardware and software; and basic image processing concepts.

Introduction to System Modeling and Simulation: Definitions: system, model, simulation. Purpose and applications of modeling and simulation in engineering. Types of models: physical, mathematical, and computer models. Steps in a simulation study.

System Concepts and Modeling Approaches: Classification of systems: continuous, discrete, stochastic, deterministic, dynamic, static. System variables, parameters, and state. Concept of lumped vs distributed systems. Mathematical modeling: linear and nonlinear systems. Mathematical and Analytical Models: Modeling with differential and difference equations. State-space representation. Transfer function models. Input-output relationships. Examples from mechanical, electrical, chemical, and computer systems. Simulation Techniques and Tools: Principles of computer simulation. Simulation languages and software (MATLAB/Simulink, Arena, Python, SimPy, etc.). Random number generation and probability distributions. Monte Carlo simulation. Discrete-Event System Simulation: Events, entities, activities, and queues. Next-event time advance mechanism. Modeling and simulation of queuing systems. Case studies in communication networks and computer systems. Verification, Validation, and Analysis: Model verification and validation techniques. Input data modeling. Output data analysis and interpretation. Confidence intervals and error analysis. Applications and Case Studies: Simulation in manufacturing and production systems. Simulation in computer networks and telecommunication. Simulation in control systems and process engineering. Mini-projects and real-world problem solving.

IMSU-EEE 475: Digital Communication Systems (2 Units C: LH 30)

Learning Outcomes

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

1. explain the concept of random processes and their parameters;
2. discuss the Hilbert transform and Markov processes and their application in digital systems; and
3. discuss the different types of digital modulation techniques and their characteristic features, including spread spectrum schemes;

Course Contents

Review of probability: basic concepts. Conditional and total probability. Distribution and density functions. Random variables: single and multiple variables. Mean variance and moments. Basic concepts, definition, and classification of random processes. Stationary process and independence property. Autocorrelation and correlation functions. Ergodicity. Power density spectrum. Linear systems. Hilbert Transforms. Noise modelling. Linear system response to random signal. Narrowband, bandlimited and bandpass processes. Optimal linear systems: matched filter for white noise and coloured noise, Wiener filters, minimum mean-squared error. Optimisation by parameter selection. Poisson points and renewals. Markov processes. Applications of random signal theory in communications. Digital modulation techniques: ASK, FSK, PSK, DPSK, M-ary modulation, continuous phase FSK, MSK, QAM, DSL Schemes. Line coding, intersymbol interference (ISI), Nyquist wave shaping, eye pattern, adaptive equalisation. Transmission over bandpass channel. Spread spectrum communications: pseudo noise sequences, direct sequence spread spectrum, frequency hopping spread spectrum, CDMA, application examples.

IMSU-EEE 477: Telecommunication Engineering Laboratory (1 Unit C: PH 30)

Course Learning Outcomes (CLOs)

By the end of this laboratory course, students will be able to:

1. **Operate** telecommunication laboratory instruments and measurement devices effectively.
2. **Generate and analyze** analog and digital communication signals in both time and frequency domains.
3. **Implement and evaluate** modulation, demodulation, and multiplexing techniques in communication systems.
4. **Measure and interpret** the characteristics of transmission media, antennas, and microwave components.
5. **Simulate** telecommunication systems using specialized software tools and compare with experimental results.
6. **Demonstrate teamwork and technical reporting skills** through laboratory experiments and mini-projects.

Course Contents

Introduction to Telecommunication Laboratory: Safety rules, use of equipment, laboratory protocols. Familiarization with basic telecommunication instruments: spectrum analyzer, signal generator, oscilloscope, function generator, RF modules. **Signals and Systems Experiments:**

Generation and analysis of analog and digital signals. Time-domain and frequency-domain analysis using oscilloscope and spectrum analyzer. Fourier transform and filtering demonstrations. **Analog Communication Systems:** Amplitude Modulation (AM) and Demodulation. Frequency Modulation (FM) and Phase Modulation (PM). Signal-to-noise ratio (SNR) analysis in analog systems. **Digital Communication Systems:** Pulse Code Modulation (PCM), Delta Modulation, and Differential PCM. Line coding techniques (NRZ, RZ, Manchester coding). Digital modulation schemes (ASK, FSK, PSK, QPSK). Error detection and correction experiments. **Transmission Media and Channels:** Characteristics of coaxial cables, twisted pair, and optical fibers. Attenuation, dispersion, and noise measurement in channels. Study of wireless channel impairments (fading, interference). **Microwave and Antenna Experiments:** Measurement of antenna parameters (radiation pattern, gain, directivity). Waveguide and microwave component characterization. Basic radar and satellite link experiments (simulation/hardware). **Networking and Switching:** Study of multiplexing (TDM, FDM). Basic switching experiments (circuit and packet switching). Introduction to VoIP and data communication experiments. **Software and Simulation Tools:** MATLAB/Simulink or equivalent for signal and system simulation. Network simulation tools (e.g., NS2/NS3, OPNET, or Packet Tracer). Laboratory projects integrating hardware and software.

4th year power & machines

- Swinburne's test on a DC machine – efficiency prediction.
- Load test on a DC series motor – speed-torque characteristics.
- Determination of slip and rotor resistance of an induction motor.
- Starting methods of a three-phase induction motor.
- Load test on a synchronous motor – V-curve and power factor determination.
- Synchronization of an alternator with infinite bus.
- Study of three-phase transformer connections (Y–Y, Y–Δ, Δ–Δ, Δ–Y).
- Load test on a single-phase induction motor – performance characteristics.
- Power factor improvement using capacitor banks.
- Simulation of power flow and machine characteristics using software (e.g., MATLAB/PSCAD/ETAP).

1. **Parallel operation of single-phase transformers.**
2. **Study of three-phase transformer connections** (Y–Y, Y–Δ, Δ–Δ, Δ–Y).
3. **Swinburne's test on a DC machine** – efficiency determination.
4. **Speed control of a DC motor** (field control and armature control methods).
5. **Starting methods of a three-phase induction motor.**

6. **Determination of slip and rotor resistance** of an induction motor.
7. **Load test on a synchronous motor** – V-curve and power factor determination.
8. **Synchronization of an alternator with an infinite bus.**
9. **Load test on a single-phase induction motor.**
10. **Power factor improvement using capacitor banks.**
11. **Simulation of power flow in a simple network** (using software like MATLAB/PSCAD/ETAP).

11.5 BMAS Course Listing

YEAR THREE

FIRST SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 301	Engineering Analysis III	1	1	-	2
2	EEE 305	Electromagnetic Field and Waves	1	1	-	2
3	EEE 311	Network Theory I	2	1	-	3
4	EEE 321	Electrical/Electronic Engineering Lab. I	-	-	1	1
5	EEE 331	Computer Organization & Architecture	1	1	-	2
6	EEE 351	Fundamental of Digital Systems	1	-	1	2
7	EEE 361	Engineering Control Systems and Design I	1	1	1	3
8	GEN 381	Statistics for Engineers	1	1	-	2
SEMESTER TOTAL						**17**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 302	Engineering Analysis IV	1	1	-	2
2	EEE 322	Electrical/Electronic Engineering Lab. II	-	-	1	1
3	EEE 342	Applied Electronics	2	1	1	4
4	EEE 352	Electrical/Electronic Measurement and Measuring Instruments	1	1	1	3
5	EEE 354	Applied Electronics	2	-	1	3
6	EEE 372	Principles of Electronic Communication	2	1	1	4
7	GET 382	Statistic for Engineers	1	-	1	2
SEMESTER TOTAL						**19**
SESSIONAL TOTAL						**36**

YEAR FOUR

COMMUNICATION ENGINEERING OPTION

S/N	Course Code	Course Title	LH	TH	PH	Units
1	EEE 401	Electrical Engineering Analysis	2	-	1	3
2	EEE 403	Fundamentals of Linear System Theory	1	1	-	2
3	EEE 431	Microprocessor System and Utilization	1	-	1	2
4	EEE 461	Process Control	1	1	-	2
5	EEE 471	Communication I	2	-	1	3
6	EEE 473	Communication Engineering Lab I	-	-	1	1

7	EEE 475	Fields and Waves in Communication	1	1	-	2
8	EEE 477	Telephone System	1	1	-	2
9	GEN 481	Computer Aided Design and Manufacturing	1	-	1	2
10	GEN 491	Technical Report Writing	1	-	-	1
11	GEN 493	Engineering Research Method	1	-	1	2
SEMESTER TOTAL						**21**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	GEN 490	Industrial Training (SIWES)	-	-	15	15
SEMESTER TOTAL						**15**
SESSIONAL TOTAL						**36**

ELECTRONIC AND COMPUTER ENGINEERING OPTION

FIRST SEMESTER

S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 401	Electrical Engineering Analysis	1	1	-	2
2	EEE 403	Fundamentals of Linear System Theory	1	1	-	2
3	EEE 431	Microprocessor System and Utilization	1	-	1	2
4	EEE 451	Semi-Conductor Technology	1	1	-	2
5	EEE 453	Advanced Electronics and Lab	2	-	1	3
6	EEE 461	Process Control	1	1	-	2
7	EEE 475	Fields and Waves in Communication	1	1	-	2
8	EEE 477	Telephone Systems	1	1	-	2
9	GEN 481	Computer Aided Design and Manufacturing	1	-	-	1
10	GEN 491	Technical Report Writing	1	-	-	1
11	GEN 493	Engineering Research Method	1	-	1	2
SEMESTER TOTAL						**22**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Unit**
1	GEN 490	Industrial Training (SIWES)	-	-	15	15
SEMESTER TOTAL						**15**
SESSIONAL TOTAL						**37**

POWER SYSTEM ENGINEERING OPTION

FIRST SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 401	Electrical Engineering Analysis	2	-	1	3
2	EEE 403	Fundamentals of Linear System Theory	1	1	-	2
3	EEE 431	Microprocessor System and Utilization	1	-	1	2
4	EEE 461	Process Control	1	1	-	2
5	EEE 441	Electrical Machines	2	-	1	3
6	EEE 443	Power System and Lab I	2	-	1	3
7	EEE 477	Telephone System	1	1	-	2
8	GEN 481	Computer Aided Design and Manufacturing	1	-	1	2
910	GEN 491	Technical Report Writing	1	-	-	1
11	GEN 493	Engineering Research Method	1	-	1	2
TOTAL SEMESTER						**21**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	GEN 490	Industrial Training (SIWES)	-	-	15	15
TOTAL SEMESTER						**15**
TOTAL SESSIONAL						**36**

YEAR FIVE

COMMUNICATION ENGINEERING OPTION

FIRST SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 561	Electrical Engineering Analysis and Control System Design II	2	-	1	3
2	EEE 571	Data Communication	1	1	-	2
3	EEE 573	Communication Engineering Lab I	1	-	1	2
4	EEE 575	Antenna and Propagation	1	1	-	2
5	EEE 577	Wireless Communication	2	-	1	3
6	EEE 581	Seminar	-	-	1	1
7	GEN 591	Engineering Management and Law	1	1	-	2
8	EEE 591	Project I	-	-	3	3
SEMESTER TOTAL						**21**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 532	Computer Application Lab	-	-	2	2
2	EEE 534	Computer Networks	2	1	-	3
3	EEE 572	Microwave Communication Engineering	2	1	-	3
4	EEE 574	Principles of Radar and Navigation System	2	1	-	3
5	EEE 576	Quality, Reliability of Communication System	2	1	-	3
6	EEE 578	Communication Network Planning and Mgt.	2	1	-	3
7	GEN 592	Professional Practice	2	-	-	2
8	EEE 592	Project II	-	-	3	3
SEMESTER TOTAL						**22**
SESSIONAL TOTAL						**42**

POWER SYSTEM ENGINEERING OPTION

FIRST SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 561	Electrical Engineering Analysis and Control System Design II	2	-	1	3

2	EEE 541	Power System Planning, Reliability & Economics	2	1	-	3
3	EEE 543	Power System Engineering Lab II	1	-	1	2
4	EEE 545	High Voltage Engineering Lab II	1	-	1	2
5	EEE 551	Power Electronics	2	1	-	3
6	EEE 581	Seminar	-	-	1	1
7	GEN 591	Engineering Management and Law	1	1	-	2
8	EEE 591	Project I	-	-	3	3
SEMESTER TOTAL						**20**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 532	Computer Application Lab	-	-	2	2
2	EEE 534	Computer Networks	2	1	-	3
3	EEE 542	Electric Drive System	2	1	-	3
4	EEE 544	Principles of Radar and Navigation System	2	1	-	3
5	EEE 546	Design of Electromechanical Devices & Machine	2	1	-	3
6	EEE 578	Communication Network Planning and Mgt.	2	1	-	3
7	GEN 592	Professional Practice	2	-	-	2
8	EEE 592	Project II	-	-	3	3
SEMESTER TOTAL						**22**
SESSIONAL TOTAL						**42**

ELECTRONIC AND COMPUTER ENGINEERIN OPTION

FIRST SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 561	Electrical Engineering Analysis and Control System Design II	2	-	1	3
2	EEE 531	Introduction Operating System	1	1	-	2
3	EEE 553	Electronic and Computer Lab II	1	-	1	2
4	EEE 571	Data Communication	2	1	-	3
5	EEE 551	Power Electronics	2	1	1	3
6	EEE 581	Seminar	-	-	1	1
7	GEN 591	Engineering Management and Law	1	1	-	2

8	EEE 591	Project I	-	-	3	3
SEMESTER TOTAL						**20**

SECOND SEMESTER						
S/N	**Course Code**	**Course Title**	**LH**	**TH**	**PH**	**Units**
1	EEE 532	Computer Application Lab	-	-	2	2
2	EEE 534	Computer Networks	2	1	-	3
3	EEE 552	Advanced Electronics II	2	1	-	3
4	EEE 554	Introduction to VLSI Design	2	1	-	3
5	EEE 556	Digital Instrumentation	2	1	-	3
6	EEE 558	Quality and Reliability of Electronic & Computer System	2	-	1	3
7	GEN 592	Professional Practice	2	-	-	2
8	EEE 592	Project II	-	-	3	3
SEMESTER TOTAL						**22**
SESSIONAL TOTAL						**42**

11.6 BMAS COURSE DESCRIPTION

11.6.1 General Engineering Coded Courses

GEN 381: Statistics for Engineers I (2 Credits)

Frequency distributions. Measures of location and dispersion in simple and group data. Elements of probability and probability distributions: normal, binomial, poison, geometric, negative binomial distributions.

GEN 382: Statistics for Engineers II (2 Credits)

Estimation and tests for hypothesis concerning the distributions. Regression, correlation and analysis of variance. Contingency tables. Non-parametric interference.

GEN 490: SIWES (15 Units)

A supervised student industrial work experience scheme. The course is designed to give students ample exposure to realities of engineering industry: the practical exposure of the student through direct participation in the work of an industry, to real life working conditions. During the training, the student becomes familiar with engineering organization, physical layout and the flow of information ma 1iais and operation. This exposure is expected to compliment and integrate the student's classroom instruction and laboratory workshop exercises.

GEN 481: Computer Aided Design and Manufacturing (2 Credits)

Review of computer hardware and software, methods of system analysis and applications. Use of computer to aid design and manufacturing and to link design a manufacturing functions. Introduction to geometric modeling, properties and representation of solids, algorithms and software, interactive computer graphics. Application of computers to planning or organization and control of manufacturing of discrete parts. NC and CNC programming languages and softwares aspects. Computer integrated manufacturing (CIM) and flexible manufacturing system. Industrial Robots. Software development and use of personal computer in designs. Application softwares used in Engineering to achieve designs such as Auto Card, Civil soft, Proteus, Spice, Corel Draw etc. Windows operating systems. Programming in C, C++, Pascal languages.

GEN 491: Technical Report Writing and Presentation (1 Credit)

Introduction to principles of effective communication with attention to the importance of emphasis, emotive content and style. Principles of technical writing and organization: data gathering and presentation, technical correspondence. Letters of inquiry and replies, letters of application and memoranda. Illustrating technical writing using tables, graphs, diagrams, equations and appendices.

Report writing: progress reports, proposals, student projects, thesis and dissertations. Oral and visual presentation of technical ideas, technical aids in presentation computer - aided technical report writing and presentation; word processing and word processing software packages. A student is to write a technical report on a topic chosen from a specialized area of interest in (ELECTRICAL AND ELECTRONIC ENGINEERING) under the guidance of an assigned supervisor.

GEN 493 Engineering Research Methods (2 UNITS)

The course aims at giving the student an opportunity to develop relevant research techniques and writing skills. It incorporates the use of elementary statistical tools in the analysis of problems principles of technical report writing.

GEN 591: Engineering Management and Law (2 Credits)

LAW: Definition and specification, application of business law to engineering. Patents and inventions; trademarks and copyrights

ENGINEERING BUSINESS: Types, the responsibilities, professional liability, and role of engineer in lawsuits. General principles of contracts; law of contract - forms of contract, criteria for selecting contractors offer and acceptance of contracts, terms of contracts; supplier duties- damage and other remedies, termination/cancellation of contracts, liquidation and penalties., exemption clauses., safety and risk. Health and safety, duties of employers towards their employees, duties imposed on employees.

Fire precaution act, Design for safety.

MANAGEMENT: General principles of management and appraisal techniques. Break through and control management theory, personal management, labour and public relations, wages and salary administration, training and man-power development.

The manager and policy development / formulation, objective setting planning, organizing and controlling, motivation and appraisal of results.

Organizational structure, goals and functions. Cost engineering:

Capital and Operating cost estimating, contingencies and allowances.

GEN 592: PROFESSIONAL PRACTICE (1 Credit)

Principles of good practices of professional Engineers in relation Ito other sister professionals and the interest of Clients and the Public. The Rules of professional Practice; the Registration Bodies and their regulations; Joint Consultative Council; SIWES Programmes; Partnerships and Consortia design and manufacture; Role of Professional Engineers, Tendering and Bidding strategies; Consultancy practice and their regulations; etc code of ethics.

11.6.2 Departmental Coded Courses

EEE 301: Engineering Analysis III (2 Units)

Course Learning Outcomes (CLOs)

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

1. demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. develop simple algorithms and use computational proficiency;
4. write simple proofs for theorems and their applications; and
5. communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

Course Contents

Review of Ordinary Differential Equations: Bessel. Lagrange, Partial differential equations: Engineering applications, Laplace transformations and other transform methods. Series solutions and special functions: such as: Gamma functions, Beta, Gauss functions, Fourier series.

EEE 302: Engineering Analysis IV (2 Units)

Course Learning Outcomes (CLOs)

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

1. solve second order differential equations;
2. solve partial differential equations;
3. solve linear integral equations;
4. relate integral transforms to solution of differential and integral equations;
5. explain and apply interpolation formulas; and
6. apply Runge-Kutta and other similar methods in solving ODE and PDEs.

Course Contents

Numerical methods and digital computer methods applied to various engineering problems including matrix inversion, approximation of functions, integration, and differentiation, ordinary and partial optimization. Application in engineering. Fast Fourier analysis. Introduction to optimization e.g. transportation problems, Dynamic programming, Design and stimulation of simple engineering components and applications. Introduction to state space formulation analysis/ applications. Monte Carlo simulation.

EEE 305: Electromagnetic Fields and Waves **(2 Units)**

Learning Outcomes

Students will be able to:

1. state and explain the various electromagnetic laws;
2. derive and explain Maxwell's equation in rectangular coordinates; and
3. explain wave propagation mechanism in conductors and unbounded dielectric media.

Course Contents

Review of electromagnetic laws in integral form and the field concept and basic vector analysis; Gauss's Law, Ampere's and Faraday's Laws; Electrostatics due to distribution of charge, magnetic fields in and around current carrying conductors, time varying magnetic and electric fields; conduction and displacement current. Maxwell's equation (in rectangular co-ordinates and vector-calculus notation), derivation of Maxwell's equation. Laplace equation and its solutions (graphical, experimental analytical). Wave propagation in good conductors, skin effect, wave equation and its solution; energy and power; radiation pressure Poynting's theorem, and momentum. Characterization of Media: plane waves polarization, reflection, reflection, refraction and standing waves. Waves modes in simple guided structures: TEM, TE and Tm modes, propagation constant, and losses. Simple examples of engineering structures for guided waves, Resonators: Introduction. TEM type and cavity type; methods of tuning and coupling. Calculation of Q-factor. Introduction of perturbation theory.

EEE 311: Network Theory **(3 Units)**

Learning Outcomes

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

1. write circuit equations for a coupled-inductor system;
2. analyse circuits containing ideal transformers and autotransformers;
3. analyse three-phase wye- and delta-connected balanced circuits;
4. plot Bode diagrams from transfer functions for SISO circuits;
5. write behavioural descriptive equations for series- and parallel-resonant circuits in the time- and frequency domains;
6. use Fourier series techniques to analyse circuit responses to periodic signals; and
7. derive two-port parameters of circuits.
8. state, explain and apply circuit theorems to d.c. circuits;
9. obtain the network response to certain input signals using phasor notations and diagrams;
10. state and apply Laplace transforms to solve passive circuits;
11. analyse non-linear circuits using approximation methods;

12. state the conditions for realisability of transfer functions;
13. design/synthesize RL, RC, LC and RLC circuits from given transfer functions; and
14. design passive and active filters from transfer functions and performance specifications.

Course Contents

Network components: Network theorems and functions; network topology and transformations. General network magnetically coupled networks, resonance in networks.

Transform methods in network analysis; single-tuned and doubly tuned function signal flow graphs; interconnection of two ports; passive and active two ports networks. Active and passive filters as examples of two-port networks: design of low-pass, m-derived filters; insertion loss.

EEE 321: Electrical/Electronic Engineering Lab I. (1 Unit).

Course Learning Outcomes (CLOs)

1. **Explain** the British and Nigerian regulations governing electrical equipment in buildings, electricity supply, and safety standards.
2. **Interpret and apply** electricity safety rules in the design, installation, and maintenance of building electrical systems.
3. **Analyze** different sources of light and lighting fittings with respect to efficiency, suitability, and compliance with standards.
4. **Perform** illumination calculations for residential, industrial, and public environments using standard engineering methods.
5. **Design** lighting systems for various applications, including indoor, floodlight, street, and industrial lighting, in accordance with regulatory and safety requirements.
6. **Evaluate** lighting designs based on energy efficiency, safety, ergonomics, and regulatory compliance.

Course Contents

British/Nigerian regulations for the electrical equipment of buildings, electricity supply regulations and electricity safety rules. Illumination engineering and design: - sources of light; lighting fittings; illumination calculations: planning and design of lighting system; flood light street lighting; industrial lighting.

EEE 322: Electrical/Electronic Engineering Lab II (1 Unit).

Course Learning Outcomes (CLOs)

1. **Explain** the principles of modular design and the use of manufacturer's data books in product development.
2. **Design and construct** simple domestic and industrial electronic/electrical products with emphasis on modularity and functionality.
3. **Apply** PCB design techniques and demonstrate proficiency in PCB fabrication processes.
4. **Identify and analyze** common electronic components used in semi-production modules and evaluate their performance characteristics.

5. **Plan and execute** installation designs for electrical/electronic systems, ensuring compliance with safety and engineering standards.
6. **Integrate** theoretical knowledge and practical skills to develop reliable, efficient, and manufacturable electronic systems.

Course Contents

Design and construction of simple domestic and industrial products with emphasis on modularity and use of manufacturer's data books. PCB design and fabrication. Study of common electronic components in semi-production module. Installation design, palling and execution of electrical/electronic systems.

EEE 331: Computer Organisation and Architecture (2 Units).

Learning Outcomes

Upon completion of this course, the students will be able to:

1. describe the fundamental organisation of a computer system;
2. explain the functional units of a processor;
3. explain addressing modes, instruction formats and programme control statements;
4. identify the organisation of various parts of a system memory hierarchy;
5. describe basic concept of parallel computing; and
6. describe fundamentals concepts of pipeline and vector processing.

Course Contents

Review of the evolution of computers. The organization of a simple digital computer: stored programme concept, data representation; instruction format; addressing modes; instruction sets; arithmetic operations, parallel processing. Memory Unit: Random access memory hierarchy and methods of direct access. I/O devices and their characteristics. The control Unit: hardware control micro-programmed control. The input and output unit: I/O buses, I/O interfaces. Application. The Arithmetic Unit.

EEE 342: Electrical Power and Machines (4 Units)

Learning Outcomes

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

1. recognise the structure and operation of electricity generation, transmission and distribution systems and the impact on the society and environment;
2. solve problems involving modeling, design and performance evaluation of power transmission lines;
3. analyse power flow in power transmission networks and apply power flow results to solve simple planning problems;
4. calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings; and
5. analyse the transient stability of simple power systems using equal area criterion.
6. explain operating principles of fundamental components of Electric Machines: motors, generators and transformers including synchronous, asynchronous, DC and special

purpose motors, AC, DC generators and autotransformers, CTs, PTs, step-up and stepdown transformers;

7. examine the magnetic field, reluctance of magnetic materials, flux and mmf in magnetic circuits and perform transformer analysis using standard testing procedures including open-circuit and short-circuit tests, voltage regulation, efficiency and circuit analysis involving transformers;
8. examine construction, working principles, characteristics and equivalent circuit of three phase synchronous generators, synchronous motors and induction motors, single phase induction and special purpose motors; and
9. analyse voltage-current characteristics, commutation of DC generators, torque speed characteristics and speed regulation of DC motors.

Course Contents

Introduction to power systems: economics of energy distribution load pattern and prediction, types of transmission and distribution systems. Thermal and hydro power plant.

Load flow: Network simplification calculations of simple transmission and distribution networks

Switch gear: Principles and functions protection and stability, requirements current and voltage level protection, steady and transient state stability. Magnetic circuits, prediction of hysteresis, eddy current and skin effect losses in machine parts.

DC Machine: Windings, generator and motor characteristics phase, open circuit and short circuit test. AC generator construction and operation polyphase induction motor; synchronous machines – construction, types and application.

EEE 351: Fundamental of Digital System and Computer Design (2 Units)

Course Learning Outcomes (CLOs)

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

1. perform base 2, 8, 16 and BCD-code (binary-coded decimal) calculations;
2. design a minimal combinatorial logic circuit that solves binary logical tasks;
3. design a minimal sequential circuit that solves binary logical tasks;
4. describe the structure of a logic gate;
5. explain the principles of programmable circuits;
6. explain the principles of analog-to-digital (AD) - and digital-to-analog (DA) conversion;
7. design synchronous networks with sequential flow charts;
8. design sequential circuits for programmable logic device (PLD) circuits; and
9. programme a PLD type Field-Programmable Gate Array (FPGA).

Course Contents

Binary System: Binary number, numbers conversion, binary addition, subtraction, division and multiplication. Boolean Algebra and Logic Gates: Basic definitions; theorems and properties of Boolean Algebra; AND and OR operations; switching circuits; standard forms of Boolean Algebra, and simplification of Boolean functions. The OR, AND and NOT gates; the NAND and NOR gates; practical applications.

Combinational Logic Circuits: Networks analysis using AND, OR and NOT gates, NAND and NOR gates synthesis, Karnaugh maps: Applications: encoders, multiplexers, demultiplexers, Adders, Random Access memories (RAMs), Read Only Memories (ROMs). Programmable Logic (PLAs) etc.

Flip Flops, sequential circuits, design procedure and applications. Codes, Counters, and Registers; BCD and Alphanumerical codes, buses signed Numbers and Complementary Arithmetic.

Introduction to microprocessors: Basic microcomputer architecture, memory, microprocessors, and applications I/P and O/P devices.

EEE 352: Electrical Measurement and Measuring Instruments (3 Units)

Course Learning Outcome (CLOs)

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

1. analyse the performance characteristics of each instrument;
2. analyse basic metres such as voltmeters and ammeters;
3. explain different types of signal analysers;
4. explain the basic features of oscilloscope and different types of oscilloscopes; and
5. apply the complete knowledge of various electronics instruments/transducers to measure the physical quantities in the field of science, engineering and technology.

Course Contents

Measurements in general: methods, error units and standards, DC and AC indicating instruments. Principles and applications of potentiometers and bridges.

Electronic instruments. Instruments for the generation and analysis of waveforms. Frequency and time measuring instruments. Transducers and Recorders. Introduction to Digital Instrumentation and Measurements.

EEE 354: Applied Electronics (3 Units)

By the end of this course, students will be able to:

1. **Explain** the principles of analog and digital electronic devices, circuits, and systems.
2. **Apply** circuit analysis techniques to evaluate the performance of amplifiers, oscillators, power supplies, and other electronic circuits.
3. **Design and implement** basic electronic circuits and subsystems for real-life applications.
4. **Use** electronic laboratory instruments, simulation tools, and testing methods to characterize and troubleshoot circuits.
5. **Analyze** the behavior of semiconductor devices, integrated circuits, and electronic subsystems under different operating conditions.
6. **Evaluate** electronic designs in terms of efficiency, reliability, safety, and cost-effectiveness.
7. **Integrate** analog and digital techniques in developing applied electronic solutions for domestic, industrial, and communication systems.

Course Contents

Oscillators: Feedback principles and circuits; feedback and negative resistance. Oscillators; phase shit Wien-bridge, Hartley, Colpitts and Crystal Oscillators; conditions for Oscillation; Frequency Stability; Multivibrators Bistable, Astable and Monostable; Clocked flip-flops and Schmitt trigger; Applications of multivibrators as memory devices, clocks, counters (up/down), and shift registers, Integrated Circuits: planner structure and Hybrid ICs, thin film and thick film circuits: printed circuits design and fabrication; typical linear and Digital ICs their properties applications; assembly and packaging considerations.

Operational amplifiers: Analysis and design Thyristor: Silicon controlled rectifiers (SCRs), triacs and diacs – the theory of operation and characteristics; applications.

EEE 361: Engineering Control Systems and Design I (3 Units).

Course Learning Outcomes (CLOs)

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

1. state examples of simple control systems;
2. state and explain different stability criteria and compensation methods for linear control systems; and
3. discuss non-linear control systems and their characteristics.

Course Contents

Basic concepts and history of control systems.

Mathematical models of control components/systems such as servomotors, valves, transducers, error detectors, electrical systems, thermal systems, pneumatic systems.

Derivation of transfer functions: Open and closed loop control systems; block diagrams and signal flow and Nyquist criteria. The Root locus method and analysis and design; Frequency response methods of analysis and design. Bode and Polar plots, gain and phase margins. Nichols Charts.

Introduction to Time Domain Analysis and design of control Systems; use of state compensation variables, techniques. State space equation and models. Compensation techniques. Analogue and digital simulation of physical systems. Laboratory study of classical control systems. Sue of electrical electronic instruments to study components and systems. Parameters and performance.

EEE 372: Principles of Electronic Communication (4 Units).

Course Learning Outcomes (CLOs)

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

1. analyse communication systems in both the time and frequency domains;
2. describe the principles of amplitude modulated and angle modulated communication systems, and be able to analyse their performance in the presence of noise;
3. explain source coding and its relations to information theory, citing Shannon's theorem;

4. describe the principles of various digital modulation systems and their properties, including bandwidth, channel capacity, transmission over bandlimited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise;
5. explain engineering fundamentals of photogeneration, photodetection and lightwave propagation for optical communications.

Course Contents

General definitions and units; principles and history of communications; international regulations on frequency allocations and bands used in various applications in electronic communications.

Modulation techniques in communications AM, FM, PM and Keying techniques OOK, PSK and Ask, principles of AM, FM, Pm spectral analysis and bandwidth. Modulators and detector/discriminators for Am and Fm signals. Digital and Pulse modulation techniques PAM, PDM, PWM and PCM. Radio wave propagations: Ground wave, tropospheric and ionospheric wave propagation, line of sight (L-O-S) propagation. Estimation of filed strength. Antennas: isotropic antenna elementary dipole. Near and far fields. Antenna parameters and directional properties. Half wave antenna, standing wave and traveling wave antennas. Practical antennas loop, horn, parabolic etc. antenna arrays broadside, end fire, Yagi, HF, VHF and SHF antennas.

EEE 401: Electrical Engineering Analysis (2 Units)

Course Learning Outcomes (CLOs)

Upon successful completion of this course, students will be able to:

1. Understand common quantities, symbols, units and formulae used in Electrical and Electronic Engineering and in Engineering practice.
2. Solve equations using beta and gamma functions
3. Formulate linear programming problems
4. Apply optimization techniques to solve our day to day problems
5. Use Relaxation, Group Relaxation, Guass-Seidal, and Jacobi techniques to solve systems of linear equations
6. Understand and explain Regression and Correlation Analysis
7. Explain Line, Surface and Volume Integrals.

Course Contents

Special topics in engineering analysis, equations and modelling techniques arising in electrical and electronic engineering practice including special mathematical techniques for antenna synthesis, forecasting in communications and electrical power systems engineering; system control random signal selection and advanced circuit synthesis, Applications of microprocessors in filter design, modern telephone switching, electrical power systems.

EEE403: Fundamental of Linear System Theory (2 Units).

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Review and apply** concepts of linear algebra, eigen space, and vector spaces to the modeling of linear dynamic systems.
2. **Formulate and solve** vector differential equations using adjoint systems and transition matrices.
3. **Develop** state-space models of linear dynamic systems and analyze system equivalence.
4. **Evaluate** system properties such as observability, state reconstructability, stability, and reachability.
5. **Apply** polynomial algebra and system matrices to characterize system dynamics and control properties.
6. **Explain and utilize** Lyapunov stability theory in analyzing system stability.
7. **Design and analyze** control strategies for multivariable systems using state-space techniques.
8. **Integrate** concepts of feedback control, network synthesis, communications, and signal processing in real-world system applications.

Course Contents

Brief review of linear algebra, Eigen space and vector space, vector differential equation. Adjoint systems, the transition matrix. State space theory and analysis for linear dynamic systems; equivalent systems. Observability and state reconstructability; stability and reachability.

Polynomial algebra; the system matrix; introduction to Lyapunov stability; control of multivariable systems. Application of feedback control, network synthesis, communications and signal processing.

EEE 431: Microprocessor Systems and Utilization (2 Units)

Course Learning Outcomes (CLOs)

Upon the successful completion of the course, students will be able to:

1. develop an ALP in 8085 microprocessor using the internal organisation for the given specification;
2. describe the architecture and functional block of 8051 microcontrollers;
3. develop an embedded C and ALP in 8051 microcontroller using the internal functional blocks for the given specification;
4. explain various peripheral devices such as 8255, 8279, 8251, 8253,8259 and 8237; and
5. explain microcontroller application and basic architecture of PIC, ARM and ATMEGA processors.

Course Contents

Review of microprocessor history, comparison of large and small computers. Microprocessor Architecture and systems, components of the microprocessors, process registers, stacks instruction handling areas, basic components (software and hardware) of a microprocessor system, (microcomputer); other specific features. A typical microprocessor device (the 8085A microprocessor) will be selected and its instruction used for hands on experience, software development procedures for microprocessor: problem definition, program design, coding and debugging, testing and documentation. Review of Microcomputer memory sections: simple memory types (RAM, ROM) features of memory interface to microprocessors, structures; design of tristate

memory sections etc. Microprocessor 1/0 sections and 1/0 design for specific processors. Microprocessors interrupt systems and their characteristic. Direct Memory Access (DMA) and interrupt systems for specific processors. Application: monitoring and control functions.

EEE 441: Electrical Machines (3 Units)

Learning Outcomes

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

1. apply the knowledge of mathematics, and engineering to the analysis of electrical machines and transmission lines;
2. design and conduct experiments, as well as analyse and interpret data;
3. identify, formulate, and solve engineering problems in the area of electromechanical energy conversion devices;
4. understand and apply some knowledge of contemporary issues concerning Electrical/Energy systems; and
5. use techniques, skills, and modem engineering tools necessary for engineering practice.

Course Contents

Electrical Machine Structures and Construction. Machine Windings, Concentrated and Distributed Windings: D. C. and AC version. The phase and multiphase windings, induction machines; review method of performance prediction of equivalent circuits and torque slip characteristics. Circle diagram. M.M.F. produced by electrical machine windings. Winding Factors and Transients, D.C. and AC Machines. Induction machines (3 phase and single phase types).

EEE 443: Power Systems and Lab I (3 Units)

Learning Outcomes

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

1. **Demonstrate understanding of power system equipment** by identifying, describing, and analyzing the design features, construction, and installation practices of transformers, machines, protection systems, and distribution center components.
2. **Apply practical knowledge of circuit theory** to analyze polyphase circuits, transmission line parameters (inductance, skin effect), and voltage-current relationships.
3. **Model and represent power system components** using equivalent circuits, generalized circuit constants, and circle diagrams, applying matrix algebra where necessary.
4. **Formulate and solve the power system load flow problem** using digital computer-based techniques such as Gauss-Seidel, Newton-Raphson, second-order methods, Hessian, and fast-decoupled methods.
5. **Implement computational efficiency methods** by applying sparsity techniques and optimal ordering in large-scale power system problem solving.

Apply stochastic methods to perform probabilistic load flow studies and evaluate their

Course Contents

Design features and Construction of simple power system equipment. Study of common equipment of power system distribution centres and installation practices, earthing, protection, transformers, machines and apparatus. Polyphase circuits. Inductance and skin effect. Current and voltage relations in a transmission line. Generalized circuit constants, circle diagrams application of Matrix

algebra to power system circulation. Modelling of power system components. Formulation of the load flow problem for digital computer solutions; methods of solution using DC, Newton Raphson, Second Order, Gauss-Seidel, Hessian and the fast decoupled techniques. Sparsity techniques and optimal orderling methods. Stochastic Load flows and applications. Fault Analysis using the digital computer. Power Systems Stability Analysis and Solutions techniques.

EEE 451: Semiconductor Technology (2 Units)

Course Learning Outcomes (CLOs)

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

1. **Explain** semiconductor fundamentals, MOSFET operation, and VLSI technology basics.
2. **Analyze** MOS device behavior, short-channel effects, and scaling challenges.
3. **Apply** VLSI fabrication processes (lithography, oxidation, deposition, etching) in device realization.
4. **Design and interpret** CMOS logic circuits, layouts, and VLSI subsystems using CAD tools.
5. **Evaluate** the performance and limitations of modern VLSI technologies, including FinFETs and low-power techniques.
6. **Assess** the role of advanced semiconductor materials and VLSI applications in emerging domains (IoT, AI, 3D ICs).

Course Contents

Review of physics of semiconductors. Principles and 1st order models of semiconductor devices. Semiconductor design technology: semicustom, full custom, wafers and VLSI design etc. Semiconductor fabrication processes: oxidation, ion implantation, etching, CCD and MOS, lithography, etc. applications.

EEE 453: Advanced Electronics and Lab I (3 Units)

Design, construction, testing and installation of various electronic products.

EEE 461: Process Control (2 Units)

Definition and elements of process control. Process control Devices: Characteristics and principles of operation of various transducers, optical transducers, mechanical transducers.

Comparison conditioning. Evaluation of process control. System evaluation criteria, dynamic response evolutional process control loop stability from simple, single variable analogue loops interactive digital controlled processes. Applications: microprocessor control techniques.

EEE 471: Communication 1 (3 Units)

Course Learning Outcomes (CLOs)

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

1. **Explain** the principles of digital and pulse communication techniques, including sampling, modulation, and multiplexing methods.

2. **Differentiate** between TDM and FDM systems and **evaluate** their relative advantages and limitations.
3. **Apply** information theory concepts such as entropy, mutual information, redundancy, and Bayes' rule to analyze communication systems.
4. **Interpret and apply** Shannon's channel capacity theorem to memoryless sources and channels, including BEC and BSC models.
5. **Analyze** the impact of noise on analog and digital communication systems, including AM, CW, and pulse modulation signals.
6. **Demonstrate** coherent and non-coherent detection techniques in additive white Gaussian noise (AWGN) channels.
7. **Design and evaluate** basic digital communication system models using concepts of sampling, coding, modulation, detection, and noise performance.

Course Contents

Review of digital and Pulse communication techniques. Sampling theory and practice modulation and multiplexing techniques and TOM techniques. Comparison TDM and FDM.

Information Theory: Entropy and information, entropy rate, mutual information and redundancy. Bayes rule. Hartley Shannon theory of communications for memory less sources and channels. Binary Erasure Channel (BEC). Calculations (BSC) Effects of noise in communication systems: Noise in Am and signals. CW and pulse modulation systems. Detection in additive white Gaussian noise, Coherent and non-coherent detection.

EEE 473: Communication Engineering Lab 1 (1 Unit)

Course Learning Outcomes (CLOs)

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

1. **Interpret and utilize** manufacturer data sheets and catalogues for the selection of communication components and product.
2. **Apply** systematic product selection procedures to choose suitable devices and subsystems for communication systems.
3. **Demonstrate** the principles of sound and practical design in the construction of communication devices and subsystems.
4. **Design and construct** fundamental communication components such as AM/FM modulators, demodulators, basic transmitters, and receivers.
5. **Evaluate** the performance and reliability of designed communication products using practical design considerations.
6. **Integrate** multiple devices and subsystems into functional communication systems following best engineering practices.

Course Contents

Use of manufacturer data sheets and catalogues; products selection procedure; principles of sound and practical design and construction of communications products.

Design and construction of various devices/components/ subsystems for communications. Examples to include AM/FM modulators and demodulators, basic transmitters and receivers.

EEE 475: Fields and Waves in Communication (2 Units)

Course Learning Outcomes (CLOs)

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

1. **Explain** the behavior of plane waves including polarization, reflection, refraction, and standing wave phenomena. *(Understanding)*
2. **Differentiate** between TEM and TE modes of guided waves, and **analyze** propagation constants and losses in simple guided structures. *(Analyzing)*
3. **Apply** transmission line theory to analyze voltage–current relationships, impedance transformation, and wave propagation. *(Applying)*
4. **Use** the Smith Chart and other analytical tools to perform impedance matching with reactive elements, stubs, and quarter-wave transformers. *(Applying/Analyzing)*
5. **Describe** the principles and operation of resonators, including TEM and cavity types, and **demonstrate** methods of tuning and coupling. *(Understanding/Applying)*
6. **Analyze and design** practical waveguide and transmission line structures for engineering applications. *(Analyzing/Creating)*
7. **Evaluate** the performance of different transmission line and waveguide systems in terms of efficiency, impedance matching, and propagation characteristics.

Course Contents

Plane Waves Polarization, reflection, refraction and standing waves. Wave modes in simple guided structures TEM, TE modes, propagation constant and losses. Simple examples of engineering structure for guided waves.

Introduction to Resonators: TEM types and cavity types, methods of tuning and coupling. Analysis of uniform Transmission Lines: Types of lines is use. Analysis of uniform Transmission Lines: generalized voltage and current relationships. Impedance transformation, Smith Chart, impedance matching with reactive elements, double and triple stud matching; quarter wave transformers; transmission line analogy of wave-guiding systems; practical wave guide structures; Applications of different lines.

EEE 477: Telephone Systems (2 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Describe the history, evolution, and fundamental principles of telephone systems and** switching technologies.
2. **Explain** the characteristics of telephone instruments, including sensitivity, distortion, and side-tone, as well as the operation of switching systems (Strowger, Crossbar, Electronic switches, PABX).
3. **Analyze** multi-exchange standards, linked numbering schemes, and national transmission standards, including subscriber trunk dialling and signalling methods.
4. **Apply** the principles of telephone traffic theory (Erlang distribution, traffic intensity, busy hour, congestion, grade of service) to evaluate system capacity and performance.
5. **Compare and contrast** mobile telephone technologies, including CDMA and GSM, with emphasis on wireless concepts and channel allocation methods.
6. **Evaluate** the performance, challenges, and distribution of telephone and mobile services within Nigeria's telecommunications infrastructure.

Course Contents

History and evolution of Telephone. Telephone and Switching systems: the telephone instrument characteristics, sensitivity, distortion, side tone Strowger, Crossbar and Electronic switches, PABX, multi exchange standards, linked numbering, national network, Transmission standards, subscriber trunk dialling, signalling Transmission standards.

Telephone traffic theory: The Ear land distribution, full availability and grading; traffic-volume, intensity, busy hour, congestion and grade of service.

Introduction to Mobile telephone. CDMA and GSM wireless concepts in telephone. Channel allocations. Telephone services and distribution in Nigeria.

EEE 531: Introduction to Operating Systems (2 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the motivations, functions, and evolution of processors, as well as the principles of concurrent programming.
2. **Describe and analyze** memory management techniques, including static relocation, virtual memory, segmentation, paging, and load control.
3. **Apply** concepts of file systems, disk management, and device drivers to understand I/O operations and file structures.
4. **Demonstrate** the use of scheduling algorithms, load control, and resource management in process scheduling.
5. **Evaluate** system-level mechanisms for protection, security, and user interface design in operating systems.
6. **Design and implement** basic models or simulations of operating system components such as process scheduling, memory management, or file handling.

Course Contents

Motivations, functions and evolution Processors and concurrent programming. Memory management: satic relocation, virtual memory, segmentation, paging load control. I/O and file systems: file structures, disk management, naming drivers. Scheduling algorithms, protection, and user interfaces etc.

EEE 532: Computer Application Lab (2 Units)

Hands-on experience on real time design and application of mini and microcomputers and specific microprocessors. Software engineering and design.

EEE 534: Computer Networks (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles and practice of computer networking, with emphasis on the Internet and layered network architectures.

2. **Identify and describe** the structure, components, and topologies of computer networks.
3. **Analyze** the operation of network services and applications such as DNS, HTTP, SMTP, and peer-to-peer systems.
4. **Demonstrate** understanding of transport protocols (TCP, UDP), congestion control mechanisms, and their role in reliable communication.
5. **Apply** routing and forwarding concepts, including intra-domain and inter-domain routing algorithms, to network design and analysis.
6. **Differentiate** between link layer technologies such as Ethernet, Wi-Fi, and token ring, and **evaluate** their performance in LAN environments.
7. **Explain and apply** concepts of quality of service (QoS), error control, circuit switching, and packet switching in communication networks.
8. **Evaluate** the design trade-offs in ATM networks, physical layer implementations, and modern networking technologies.

Course Contents

Principles and practice of computer networking with emphasis on the internet. The structure and components of computer networks. Networking topologies.

Networks services and applications, ANS, HTTP, SMTP, Peer to Peer systems. Network transport architectures, TCP/IP, UDP, TCP congestion control. Routing and forwarding, intra – domain and inter – domain routing algorithms. Link layers and local area networks especially Ethernet, Wi-Fi and token ring. Quality of service. ATM network, Error control, physical layer and layered architectures. Circuit and packet switching.

EEE 541: Power System Planning, Reliability and Economics (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Describe** Nigeria's energy resources and the various methods of electrical power generation.
2. **Apply** techniques of load forecasting and source analysis for effective power system planning.
3. **Explain and analyze** the principles and practice of low-voltage AC transmission and distribution systems.
4. **Utilize** mathematical methods for transmission network planning, source utilization, and optimization.
5. **Perform** reliability calculations to assess and improve power system planning and operation.
6. **Evaluate** power system investment models and pricing rules, including economic implications for Nigeria's electricity market.

Course Contents

Nigeria energy resources. Methods of Electrical power generation. Load forecasting and source analysis. Principles and practice of L. V. A. C. transmission and distribution. Mathematical Methods used in planning and source utilization and of transmission networks. Reliability calculations for power system planning. The power system investment pricing rules. Energy sector modelling. Pricing and load management. Network economics and application to the Nigeria Power system. Rural Electrification.

EEE 542: Electric Drive System (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the steady-state and transient operating characteristics of DC and AC machines.
2. **Apply** the generalized two-axis theory of electrical machines using differential equations to model machine behavior.
3. **Solve** practical transient problems such as short-circuits, oscillations, and dynamic disturbances in electrical machines.
4. **Incorporate** the effects of magnetic saturation and other non-linearities into machine performance analysis.
5. **Analyze** the impact of eddy currents in iron and copper parts on machine transient performance.
6. **Evaluate** machine performance under different transient conditions for improved design and operation.

Course Contents

A study of the steady state and transient operation of dc and ac machines. The generalized two axis theory of electrical machine in the form of differential equations. Solution of short-circuit, oscillation and other practical transient problems. Methods of allowing for saturation and other non-linear effects, eddy currents in iron and copper parts of the machine their effect on transient performance.

EEE 543: Power System Engineering Lab (2 Units)

Testing and location of faults, certification. Layouts, architects plans, frame works and equipment layout, installation design, planning and execution application to domestic, industrial consumers.

EEE 544: Rotating Machine Control (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Represent** electromechanical systems graphically using block diagrams and signal flow graphs.
2. **Apply** Mason's formula to compute the gain of a signal flow graph in linear system analysis.
3. **Demonstrate** the use of analogue computer techniques for representing and analyzing dynamic systems.
4. **Explain and analyze** the role of DC machines in feedback systems and AC machines in control systems.
5. **Discuss** recent trends in synchronous machine modelling within the electricity supply industry.
6. **Develop and use** system equivalents for dynamic and transient stability studies in power systems.

Course Contents

Graphical representation of electromechanical systems block diagram of linear systems, signal flow graphs or linear systems. Mason's formula for computing the gain of a signal flow graph, signal flow graphs, analogue computer representation of dynamic system.

Use of D.C. machines in feedback systems. Use of A.C machine in control systems. Recent trends in synchronous machine modelling in the electricity supply industry. System equivalent for dynamic and transient stability studies.

EEE 545: High Voltage Engineering Technology (3 Units).

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles and applications of HV cascaded transformers and series resonant testing techniques.
2. **Describe and analyze** DC multiplier circuits, impulse voltage generation, and methods of impulse waveform analysis.
3. **Discuss** the mechanisms of avalanche and streamer breakdown in gases and their implications for insulation design.
4. **Analyze** dielectric loss, relaxation phenomena, and failure mechanisms in solid insulating materials.
5. **Explain** the properties, conduction mechanisms, and breakdown processes in dielectric liquids and vacuum insulation.
6. **Evaluate** the performance of insulation systems under different stress conditions to predict breakdown behavior.
7. **Introduce and apply** the basic principles of circuit breaker technology for power system protection.

Course Contents

HV cascaded transformers and series resonate testing. D.C. multiplier circuits, Impulse generation and analysis. Avalanche and steamer breakdown in gases. Dielectric loss and relaxation, failure mechanism in solid. Vacuum insulation. Conduction and breakdown in dielectric liquids. Introduction to circuit breaker technology.

EEE 546: Design of Electromechanical Devices and Machines (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the fundamental principles, specifications, and design considerations of electromechanical devices and electrical machines.
2. **Design** transformers, including core, winding, and tank structures, with consideration of thermal ratings, momentary limitations, and specific loadings.
3. **Develop** design specifications and performance parameters for induction motors, including ratings, dimensions, output coefficient, cooling, and load characteristics.
4. **Design and analyze** synchronous machines with emphasis on excitation systems, governing systems, cooling, insulation, and stray loss minimization.
5. **Apply** design methodologies to commutator machines, considering construction, operating ratings, and performance requirements.

6. **Evaluate** the thermal, mechanical, and electrical performance of designed machines to ensure compliance with standards and specifications.

Course Contents

Design of Electromechanical Devices and Electrical machines. Design of transformers, Design specifications, core, and windings tank designs, Thermal rating momentary limitation, specific loading system.

Induction motors, Design specifications, rating and induction motors; Design specifications, rating and dimensions, output coefficient, specific loadings, cooling performance characteristics. Design of synchronous Machines, Design specifications, rating and dimension, excitation and governing system Design, cooling system insulation, stray losses Design of commutator machine.

EEE 548: Power System Protections (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles of protection for high- and low-voltage power systems.
2. **Identify and analyze** overcurrent and earth-fault protection schemes, including pilot-wire, carrier-current, and VHF communication-based methods.
3. **Apply** the concepts of distance protection, zone selection, acceleration, and inter-trip schemes in power system protection.
4. **Differentiate** between electromagnetic, solid-state, and digital protection equipment, and **evaluate** their applications in modern substations.
5. **Describe and assess** the operation of protective devices such as fuses and earth leakage protection systems.
6. **Evaluate and recommend** appropriate protection and control schemes to enhance substation safety, reliability, and efficiency.

Course Contents

Principle of protection of high and low voltage. Over current and earth-fault identification protection-pile to wire, and carrier current and VHF communication principles, distance measurements, selection of zones acceleration and intertrip schemes. Electromagnetic, solid state and digital equipment for protection and control of substations. Fuses and earth leakage devices.

EEE 551: Power Electronics (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles, design, and construction of power rectifiers and their applications in power circuits.
2. **Apply** rectification and smoothing techniques, as well as voltage and current regulation methods, in designing regulator circuits.

3. **Analyze** the characteristics and limitations of power transistors under high-current and high-voltage conditions.
4. **Design** and evaluate the operation of power semiconductor devices such as triacs, quadracs, and other controlled power devices.
5. **Describe** the principles of high-power microwave generators and **assess** their practical applications.
6. **Integrate** power rectifiers, regulators, and high-power devices into functional power electronic systems with specified performance requirements.

Course Contents

Principles, design construction of power rectifiers and their applications in power circuits; rectification and smoothing techniques; voltage and current regulation and regulator circuits; The characteristics and limitations of power transistors at high current and voltage; design of triacs, quadraces and other power devices. High power microwave generators. Applications.

EEE 552: Advanced Electronics (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles and operation of microwave amplifiers, oscillators, frequency multipliers, switches, and detectors.
2. **Describe and analyze** the dynamics of electron beams, space charge effects, and electron wave interactions in microwave devices.
3. **Analyze** the working principles, characteristics, and applications of klystrons, magnetrons, and other microwave tubes.
4. **Demonstrate** understanding of Travelling Wave Tubes (TWTs) and Travelling Wave Tube Amplifiers (TWTAs), including their applications in communication and radar systems.
5. **Evaluate** the performance, limitations, and design considerations of various microwave sources for practical applications.
6. **Discuss** emerging trends in the development of microwave devices and sources for modern technologies.

Course Contents

Microwave amplifier and oscillators, frequency multipliers, switches, detector dynamics: dynamics: electron electron beam, space brief charge treatment of and klystron electron waves. Travelling Wave Tubes (TWT) and Travelling Wave Tube Amplifiers (TWT A) and applications. Klystrons and magnetrons etc and their applications. Trends in microwave device and sources development.

EEE 553: Electronic and Computer Engineering Lab II (2 Units)

Design, construction, testing and installation of various electronic products.

EEE 554: Introduction to VLSI Design (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles of large-scale NMOS design, including stick diagramming and scalable design rules.
2. **Analyze** the operation of NMOS transistors and their use in switches, gate logic, and programmable logic arrays (PLAs).
3. **Apply** two-phase dynamic design techniques in the implementation of finite state machines.
4. **Evaluate** design trade-offs in terms of speed, power consumption, and scalability for NMOS circuits.
5. **Demonstrate** layout techniques, including floor planning and interconnect communication, for efficient NMOS circuit design.
6. **Design** functional NMOS-based digital systems using stick diagrams, layout rules, and practical optimization strategies.

Course Contents

Principle of large-scale in NMOS design: stick diagramming:

NMOS Transistors; switch and gate logics; programmable logic arrays; 2-phase dynamics design; finite state machines; scalable design rules; speed and power consideration; floor planning and communication; layout techniques.

EEE 556: Digital Instrumentation (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles, construction, and operation of digital measuring instruments such as digital voltmeters, digital frequency meters, and automatic bridges.
2. **Identify and analyze** the key factors influencing the performance of digital measurement systems and propose techniques for improving their accuracy, speed, and reliability.
3. **Apply** modern techniques, including the use of microprocessors and computers, in automatic test equipment for instrumentation, measurement, and data logging.
4. **Evaluate** various signal analysis techniques and their role in enhancing the performance of digital instrumentation systems.
5. **Design and simulate** transfer function analyzers and precision operational amplifier-based circuits for measurement and test systems.
6. **Integrate** digital instrumentation components into complete measurement and test systems, demonstrating efficiency in data acquisition, processing, and performance enhancement.

Course Contents

Digital measuring digital voltmeter, digital frequency meter, automatic bridges etc. factors influencing performance. Techniques for enhancing overall system performance.

Automatic test equipment: current techniques and systems; use of computers and microprocessors in instrumentation system, logging signal analysis techniques. Design analysis and construction of transfer function analysers. Precision operational amplifiers.

EEE 558: Quality, Reliability and Maintenance of Electronic and Computer Systems (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the fundamental concepts of reliability in electronic systems, including MTBF and product reliability prediction.
2. **Analyze** the factors affecting electronic system reliability at both the design and manufacturing stages.
3. **Apply** design-for-reliability and design-for-testability principles in electronic circuit and system development.
4. **Evaluate** pre-manufacturing and post-manufacturing techniques such as burn-in testing and firmware quality assurance for enhancing product reliability.
5. **Assess** methods of software reliability prediction and assurance in embedded and electronic systems.
6. **Integrate** reliability and quality assurance considerations into the design and testing of electronic systems for improved performance and lifecycle management.

Course Contents

Introduction to the concept of reliability in electronics. Designing for reliability, testability. Pre-and post-manufacturing. Burn-in and firm- ware quality assurance: MTBF concept. Product reliability and prediction. Software reliability.

EEE 561: Engineering Control Systems Analysis and Design II (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles of frequency analysis, Root-Locus methods, and their application to sampled-data systems.
2. **Analyze** electrical and mechanical control systems (voltage, current, position, and speed) using classical and modern control approaches.
3. **Design and realize** compensation networks for improving the stability and performance of control systems.
4. **Apply** Z-transform and modified Z-transform techniques to digital control system modeling and analysis.
5. **Perform** state-space modeling and analysis of linear control systems, including transition matrices and system response.
6. **Develop** digital control algorithms for on-line computer control and microprocessor-based applications.

Course Contents

Review of frequency analysis and the Root-Locus-Locus method; Analysis of sampled data systems; electrical control of voltage, current etc., mechanical control of position and speed; realization of compensation networks.

Z-transformation and modified Z-transformation; State-space analysis of control system; the transitions on-line computer control, derivation of digital control algorithms; Microprocessor applications. Describing function principles; Phase plane principles: functions; Lyapunov's method of stability and analysis; linear systems.

EEE 571: Data Communication (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the principles of data communication links, including channels, media, configurations, and ITU recommendations.
2. **Analyze** the performance of data transmission over voice-grade circuits, considering design requirements and limitations.
3. **Apply** different modulation techniques, modem interconnections, and data encryption methods in digital communication systems.
4. **Evaluate** techniques for enhancing channel capacity, including packet switching, multiplexing, and synchronization methods.
5. **Describe and assess** the structure, organization, and requirements of international and national digital networks.
6. **Implement** interfacing standards, communication protocols, and information coding techniques for reliable data transfer.
7. **Apply and compare** error detection and correction methods to improve reliability in data communication systems.

Course Contents

Data communication-links: channels, media and configurations. Transmission over voice-grade circuits. Design considerations. ITU recommendations. Modulation techniques and modems interconnections and data encryption. Methods of enhancing channel capacity, packet-switching data networks. Multiplexing and synchronization techniques; organization of international and notional digital networks requirements. Interfacing, protocols, information codes, error correction for data communication. Practical data communication systems.

EEE 572: Microwave Communication Engineering (3 Units)

Review of Available frequency bands for Microwave communications. Route and Site Selection - Site considerations, influences of terrain obstructions on the choice of microwave path; atmospheric effects on microwave beam. Influence of weather and objects in azimuth. Clearance and path profile representations and calculations. Fresnel zone and Fresnel zone ellipsoids.

Software approach in determining Fresnel zones and- antenna heights.

Interference co-ordination in microwave systems.

Equipment selection for microwave systems radio equipment, RF combiners, towers, waveguides, antenna systems, radomes, repeaters and links.

Satellite Communications System: Types, Overview radOme5, of the technology. Path-Toss calculations. Access and modulation techniques, use, earth-station technology. Design and losses calculation ITU recommendations. VAST networks and Direct

Broadcast Satellites (DBS). System reliability estimates: - reliability with respect to multipath non-selective fading equipment reliability consideration.

EEE 573: Communication Engineering Lab II (2 Units)

Continuation installation organization of COE 413. Design, construction, testing and installation of appropriate communication Package for and an organization. Monitoring and testing on communications systems. Communications systems and circuit protection procedures.

EEE 574: Principle of Radar and Navigation Systems (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Describe** the history of radar development and its applications across various fields.
2. **Explain** the concept of radar frequencies, radar range equation, and factors such as target cross-section, transmitter power, antenna parameters, noise, and minimum detectable signal.
3. **Analyze** the performance of radar systems using the radar range equation under different operating conditions.
4. **Differentiate** between continuous-wave (CW), Doppler, moving-target indication (MTI), tracking radar, and laser radar systems.
5. **Evaluate** radar system design parameters for detecting and tracking moving or stationary targets.
6. **Apply** radar principles to practical scenarios, demonstrating the trade-offs between detection capability, power requirements, and system limitations.

Course Contents

History of Radar Development. Radar Application radar frequencies. Radar Equation; radar range, cross-section of a target, transmitter power, Radar Equation; radar range, cross-section of a target, transmitter power; Antenna parameters, minimum detectable signal, noise, Radar Systems: CW, Doppler, moving- target indication (MTI); tracking radar, laser radar system

EEE 575: Antenna and Propagation (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the wave equation in terms of electromagnetic potentials, including retarded and Hertzian potentials, and their applications.
2. **Apply** integration equations in free space to analyze electromagnetic radiation problems.
3. **Analyze** the radiation fields of a linear centre-fed thin-wire antenna and their characteristics.
4. **Interpret and apply** symmetric Maxwell's equations, vector potentials, and the field equivalence theorem in antenna theory.
5. **Evaluate** antenna directive gain and its impact on communication system performance.
6. **Design and analyze** antenna arrays using two isotropic point sources for broadside and end-fire configurations.
7. **Assess** the performance of transmit–receive systems, including adaptive schemes for improved efficiency.

Course Contents

Wave equation in terms of Electromagnetic potentials: Retarded and Hertzian potentials. Integration equations in free space.

Radiation fields of a linear centre fed thin-wire antenna. Symmetric Maxwell's equations and their vector potentials: the field equivalence theorem. Antenna directive gain. Antenna array:

Two Isotropic point sources of equal amplitude and spacing, broad/end fire array. Transmit Receive system: Adaptive scheme.

EEE 576: Quality, Reliability and Maintenance of Communication Systems (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the functions of quality control and its relationship to production, engineering, purchasing, and sales.
2. **Apply** sampling plans, control charts, and confidence limits in monitoring and improving communication systems.
3. **Analyze** the effectiveness of quality control techniques in practical communication system applications.
4. **Evaluate** reliability design principles considering environmental effects, component failure modes, system reliability, and typical failure distributions.
5. **Perform** design analysis for predicting system failure rates and estimating product lifetime.
6. **Examine** Nigerian communication system case studies to identify reliability challenges and quality control measures.
7. **Differentiate** types of maintenance and develop maintenance planning strategies, including inspection scheduling, equipment replacement, and overhaul policies.

Course Contents

Quality control, function of quality control and relationship to production, engineering purchasing and sales. Effectiveness of quality control, sampling plans and procedures.
Control charts and confidence limits. Applications to practical communications systems. Application of reliability design; Environmental effects; component modes of failure and- system reliability; typical failure distributions; Design analysis of failure and system reliability; typical failure distributions. Design analysis of failure and life-time.
Case studies of Nigeria Communications systems.
Maintenance: types, maintenance planning, frequency and intensity of inspection, optimal replacement/overhaul maintenance policy of equipment. Equipment replacement conditions. System design for ease of maintenance. Documentation requirements. Maintenance instruments requirements.
Application to typical communications networks and equipment.

EEE 577: Wireless Communication (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Explain** the fundamental concepts of wireless communication, including fixed and mobile propagation channel modelling, broadband and narrowband systems.
2. **Describe and compare** different wireless standards and technologies such as GSM, UMTS, and emerging mobile communication systems.

3. **Analyze** wireless channel models and their impact on system performance.
4. **Differentiate and evaluate** multiple access technologies (FDMA, TDMA, CDMA, OFDMA, and spread spectrum) for various communication scenarios.
5. **Apply** knowledge of antenna technologies such as adaptive (smart) antennas and multiple element systems to enhance wireless communication performance.
6. **Examine** wireless modulation techniques such as Continuous Phase Modulation (CPM) and Orthogonal Frequency Division Multiplexing (OFDM), and their applications in modern systems.
7. **Assess** future trends in mobile and broadband communication technologies, including satellite and optical fiber communication.
8. **Integrate** knowledge of wireless communication concepts to design or simulate a basic wireless communication system.

Course Contents

Introduction to wireless communication: - Fixed & Mobile propagation channel modelling.

* Broadband and narrowband systems
* GSM, UTM, etc.
* Basics
* Wireless channel modelling
* Access technologies: -FDMA, TDMA, Spread spectrum, CDMA, OFDMA
* Antenna technology: -Adaptive antenna (Smart), Multiple element
* Wireless Modulation techniques: -CPM, OFDM
* Future technology (mobile)
* Satellite communication,

**Optic Fibre Communication (Broadband).

EEE 578: Communication Network Planning and Management (3 Units)

Course Learning Outcomes (CLOs)

By the end of this course, students will be able to:

1. **Define and classify** different network configurations and planning approaches, including strategic, long-term, and short-term planning.
2. **Explain** the processes of routing, numbering, charging, and transmission planning within telecommunication networks.
3. **Analyze** the principles of network design optimization and apply them to improve efficiency and reliability.
4. **Apply** network traffic management principles to ensure Quality of Service (QoS) and efficient utilization of resources.
5. **Differentiate** types of network management (fault, configuration, accounting, performance, and security) and their roles in overall system performance.
6. **Examine** network management architectures, protocols, and ISO network management models, including SNMP.
7. **Evaluate** network planning strategies and management solutions for both current and future telecommunication systems.

Course Contents

Definitions and types of network configurations. Types of network planning and planning process; strategic planning, routing, numbering, charging and transmission planning. Long term and short term planning. Network design optimization. Network traffic management principles. Network management types. Network management architecture and protocols. ISO network management models-SNMP.

EEE 581: Seminars and Industrial Visits (2 Units)

Each student will be required to present a seminar on an approved topic (analytical/experimental) in the related chosen option in electrical and electronic engineering. Industrial visit to engineering establishments and allied industries and firms will be made and the student's participation in and knowledge acquire in these visits assessed on the basis of written reports submitted by the student.

EEE 591/592: PROJECT I/II (3 UNITS EACH)

Investigation of suitable topics in any of the options of study, involving literature search, design, computer techniques and construction etc. under the direction of a staff.