NIGER DELTA UNIVERSITY
Wilberforce Island, Bayelsa State

Department of Electrical and Electronic Engineering
Student Handbook

October, 2023

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FORWARD

The Electrical and Electronic Engineering Department of Niger Delta University was formally established in the 2001/2002 year, when it admitted its first set of students. The programme awards the bachelor of Engineering (B. Eng.) in Electrical/Electronic Engineering after five academic sessions, and graduated its first batch of Engineers in the 2005/2006 academic year.

The University has a robust staff Development programme for the Department. Several graduates from the Department's grandaunts have been employed under this scheme and some have acquired their terminal degrees under this programme

The Bayelsa state government has continue to demonstrate her commitment in making engineering a top priority in the development of the Niger Delta University. With this commitment, and the expected support from the muti-national industrial community and strive to make Electrical and Electronic engineering the pride of NDU. This handbook is intended to give the student an overall view of the courses in the departments through the period of their studentship.

Engr. Dr. Priye Kenneth Ainah
Ag. HOD of the Department of Electrical and Electronic Engineering
October 2023

PHILOSOPHY

The five-year Bachelor of Engineering (B.Eng.) programme aims to provide students with a broad and flexible education in electrical power system, electronic, communications and computer engineering, and to prepare its graduates for rapidly changing technological fields, and give them a sound basis for professional practice, advanced education, active citizenship, and lifelong learning.

The students are prepared to expand this knowledge through research into new technologies, design methods, and analysis techniques that link the knowledge with multi-disciplinary fields and advance the state of the art.

With a knowledge of contemporary technological issues and their impact globally, economically, and environmentally, electrical, electronic, communications and computer engineers are at the forefront of advances that is dramatically transforming our society.

Objectives of the Programme

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct engineering and scientific experiments.
- An ability to analyze and interpret engineering and scientific data.
- An ability to design, implementation, and evaluation of components, processes, or systems to meet performance requirements.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve a range of electrical engineering problems and an understanding of professional and ethical responsibility.
- An ability to convey technical material through formal written papers/reports.

ADMISSION REQUIREMENTS

1. Joint matriculation examinations:
   O'level/SSCE credit in five subjects, which should usually include; Mathematics, Physics, Chemistry and English Language and any other Science related subject. The O level/SSCE credits must not be in more than two (2) sittings.
2. Direct entry (200 level)
   Admission through direct entry was started by the University in the 2013/2014 academic session.

DURATION OF PROGRAMME

The B.Eng. Programme in Engineering runs for five years (10 semesters) comprising of classroom studies, workshop/laboratory, fieldwork and supervised industrial work experience (SIWE) attachment as follows:

- Year I, II and III Classroom, Workshop/Laboratory Work
- Year II long vacation 3 months SIWES
- Year III long vacation 3 months SIWES
- First Semester of Year IV Classroom, Workshop/laboratory.
- Second Semester and long vacation of Year IV 6 months SIWES
- Year V Classroom, Workshop/laboratory Work and Final year Project.

COURSE GROUPING IN THE DEPARTMENT

Group No.	Group Title/Course	Year	Semester
0	**General Electrical Engineering**		
	MATLAB for Electrical Engineers	3	II
	Design and Installation	4	I
	Supervised Industrial Work	4	II
	Experience	5	II

	Reliability and Maintainability		
1	**Electric Circuits & Fields**		
	Circuit theory I	2	II
	Circuit theory II	3	I
	Field theory I	3	I
	Field theory II	4	I
2	**Measurement and Instrumentation**		
	Measurements and Instrumentation	3	I
3	**Computer Engineering**		
	Logic and Digital Systems I	2	II
	Logic and Digital Systems II	3	I
	Introduction to Computer	2	II
	Engineering	3	I
	Introduction to Operating System	2	II
	Data Structures and Algorithm	3	I
	Object Oriented programming with	4	I
	Java	4	I
	Further Programming with Java	4	I
	Web Technologies	5	I
	Microprocessors	5	II
	Microprocessor Application		
	Computer Network and Distributed		
	Systems		
4	**Control Engineering**		
	Control I	4	I
	Control II	5	I
5	**Electronic Engineering**		
	Electronic Circuit I	3	I
	Electronic Circuit II	3	II
	Electronic Systems Design	5	I
	Pulse & Digital Electronics	5	I
	Power Electronics	4	I
6	**Communication Engineering**		
	Signal & Systems I	3	I
	Signal & Systems II	3	II
	Communication Systems Principles	4	I

	Modern Communications Systems Microwave & Satellite Communications Antennas and Propagation Mobile and Wireless Communications	5 5 5 5	II II I
7	**Electrical Machines and Drives** Electrical Machines I Electrical Machines II Electric Drives	 3 3 5	 I II I
8	**Electrical Power Engineering** Principles of Power Engineering Renewable Energy Systems High Voltage Engineering Power Systems Analysis Power Systems Design Power Transmission and Distribution Power Systems Economics & Operations Power Systems Faults and Protection	 3 4 4 4 5 5 5 5	 II I I I II II II I

DESCRIPTION OF COURSES

100 LEVEL, 1ST SEMESTER

S/N	Course Code	Course Title	L	T	P	Units
1	GST 101	Use of English I	2	-	3	3
2	MTH 105	General Mathematics I	3	-	3	2
3	MTH 107	General Mathematics II	2	-	-	2
4	PHY 105	General Physics I	2	2	-	3
5	PHY 107	General Physics Laboratory I	-	-	1	1
6	CHM 101	General Chemistry I	2	2	-	2
7	CHM 103	General Chemistry Laboratory I	-	-	1	1
8	FCE 131	Engineering Graphics I	1	2	-	2
9	GST 141	Fundamentals of Computer Science	3	-	-	3
TOTAL			**13**	**6**	**12**	**20**

100 LEVEL, 2ND SEMESTER

S/N	Course Code	Course Title	L	T	P	Units
1	GST 102	Use of English II	2	-	3	3
2	GST 110	Nigeria People and Culture	3	-	-	3
3	FCE 132	Engineering Graphics II	2	2	-	2
4	MTH 106	General Mathematics III	3	-	3	3
5	MTH 108	General Mathematics IV	3	-	3	3
6	PHY 106	General Physics II	2	1	-	3

7	PHY 108	General Physics Laboratory II	-	-	1	1
8	CHM 102	General Chemistry II	2	2	3	3
9	CHM 108	General Chemistry Laboratory II	-	-	1	1
10	FCE 142	Engineer –in- Society	2	2	-	1
TOTAL			**13**	**8**	**12**	**23**

200 LEVEL, 1ST SEMESTER

S/N	**Course Code**	**Course Title**	**L**	**T**	**P**	**Units**
1	FCE 201	Engineering Analysis I	2	-	3	3
2	EEE 211	Circuit Analysis I	1	2	-	3
3	EEE 231	Introduction to Computer Engineering	1	2	-	2
4	FCE 265	Engineering Statics	2	-	3	3
5	FCE 221	Material Science	2	2	-	3
6	FCE 267	Fundamentals of Thermodynamics	2	2	3	3
7	GST 221	Peace And Conflict Resolution Studies	2	-	-	2
8	FCE 243	Laboratory Practice I				1
TOTAL			**12**	**8**	**9**	**20**

200 LEVEL, 2ND SEMESTER

S/N	Course Code	Course Title	L	T	P	Units
1	FCE 202	Engineering Analysis II	2	-	3	3
2	FCE 242	Computer Programming	1	2	-	2
3	EEE 232	Logic and digital systems I	2	-	3	3
4	EEE 234	Computer engineering II	2	2	3	4
5	EEE 212	Circuit Analysis II	1	2	3	3
6	FCE 264	Engineering Dynamics	2	-	3	3
7	GST 212	Philosophy and logic	3	-	-	3
8	FCE 248	Laboratory Practice II				1
TOTAL			**13**	**6**	**15**	**19**

300 LEVEL, 1ST SEMESTER

S/N	Course Code	Course Title	L	T	P	Units
1.	EEE 335	Introduction to Operating Systems	2	2	0	2
2.	FCE 301	Engineering Analysis I	2	2	0	3
3.	EEE 361	Signal and systems I	3	2	0	3
4.	EEE 321	Measurement & Instrumentation	2	2	0	3

5.	EEE 371	Electrical Machines I	3	0	3	3
6	EEE 373	Electrical Machines Laboratory	-	-	1	1
6.	EEE 331	Logic and Digital Systems II	3	0	3	3
7.	EEE 333	Object Oriented Software Engineering	3	0	2	3
8.	EEE 351	Electronic Devices and Circuit I	2	2	0	2
9	EEE 341	Electronic Circuit Laboratory				1
TOTAL			**21**	**10**	**8**	**24**

300 LEVEL, 2ND SEMESTER

S/N	**Course Code**	**Course Title**	**L**	**T**	**P**	**Units**
1	FCE 302	Engineering Analysis II	2	2	0	3
2	GST 300	Entrepreneurship Studies	2	0	0	2
3	EEE 362	Signals and Systems II	2	0	2	3
4	EEE 302	MATLAB for Electrical Engineers	1	0	3	2
5	EEE 380	Principles of Power Engineering	3	0	0	3
6	EEE 372	Electrical Machines II	3	0	3	3

7	EEE 314	Electromagnetic Field Theory I	3	2	0	3
8	EEE 352	Electronics Circuit II	3	0	2	3
9	EEE 334	Computer Architecture	2	0	0	2
TOTAL			**18**	**10**	**8**	**24**

400 LEVEL, 1ST SEMESTER (ELECTRONICS OPTION)

S/N	Course Code	Course Title	L	T	P	U
1	EEE 433	Further Programing with Java	3	0	3	3
2	EEE 431	Microprocessors	3	0	3	3
3	EEE 441	Control Engineering I	2	0	2	3
4	EEE 439	Web Technologies	2	2	0	3
5	EEE 403	Design and Installation	1	0	2	2
6	EEE 415	Field theory II	2	2	2	4
7	EEE 461	Communications Systems	2	0	3	3
8	EEE 451	Pulse and Digital Electronics	2	2	2	3
TOTAL			**14**	**6**	**14**	**24**

400 LEVEL, 1ST SEMESTER (ELECTRONICS OPTION)

S/N	Course Code	Course Title	L	T	P	Units
1	EEE 483	Power Electronics	3	0	3	3
2	EEE 431	Microprocessors	3	0	3	3
3	EEE 441	Control I	2	0	2	3

4	EEE 489	Renewable Energy Systems	2	2	0	2
5	EEE 403	Design and Installation	1	0	2	2
6	EEE 415	Field theory II	2	2	2	3
7	EEE 461	Communications Systems	2	0	3	3
8	EEE 451	Pulse and Digital Electronics	2	2	2	3
9	FCE 411	(Technical Communications(Report Writing & Presentation)	2	-	-	2
TOTAL			**14**	**6**	**14**	**24**

400 LEVEL, 2ND SEMESTER

S/N	Course Code	Course Title	Units 12
1	FCE 402 SIWES II	Industrial Training (Not for Students who have more than 6units of Carryover Courses in the 2nd Semester)	

500 LEVEL, 1ST SEMESTER (POWER OPTION)

S/N	Course Code	Course Title	L	T	P	Units
1	EEE 441	Control I	2	0	3	3
2	EEE 481	Electrical Power Systems	2	2	0	4
3	EEE 489	Renewable Energy Systems	2	2	0	2
4	EEE 485	High Voltage Engineering	2	0	3	4
5	EEE 483	Power Electronics	2	0	2	3
6	EEE 403	Design and Installation	1	0	2	2
7	EEE 487	Power Systems Analysis	3	0	3	3
8	FCE 411	(Technical Communications(Report Writing & Presentation)	2	-	-	2
TOTAL			**14**	**4**	**12**	**24**

500 LEVEL, 1ST SEMESTER (ELECTRONICS OPTION)

S/N	Course Code	Course Title	L	P	T	U
1	EEE 541	Control II	2	0	3	3
2	EEE 573	Electrical Drives	2	0	3	3
3	EEE 585	High Voltage Engineering II	2	0	2	3
4	EEE 583	Power Transmission and Distribution	2	2	0	3
5	EEE 571	Engineering Management	3	0	0	3
6	EEE 587	Power Systems Fault & Protection	3	0	2	4
7	EEE 591	Project	--	--	--	--
TOTAL			**14**	**2**	**10**	**19**

500 LEVEL, 1ST SEMESTER (ELECTRONICS OPTION)

S/N	Course Code	Course Title	L	P	T	U
1	EEE 534	Computer Networks & Distributed Systems	2	0	2	3
2	EEE 562	Microwave and Satellite Communications	2	2	0	3
3	EEE 564	Antennas and Propagation	3	0	0	3
4	EEE 504	Reliability and Maintainability	2	0	2	3
5	EEE 572	Entrepreneurship and Industry	2	0	0	2
6	EEE 592	Project	0	0	12	6
7	FCE 532	Industrial Law and Relations	2	0	0	2
TOTAL			**14**	**2**	**16**	**22**

YEAR 5 (POWER OPTION) SEMESTER 2

S/N	Course Code	Course Title	L	P	T	U
1	EEE 584	Renewable Energy System Design	2	2	0	3

2	EEE 588	Power Systems Design	2	2	0	3
3	EEE 504	Reliability and Maintainability	2	0	2	3
4	EEE 586	Power Systems operations	2	0	2	3
5	EEE 572	Entrepreneurship and Industry	2	0	0	2
6	EEE 592	Project*	0	0	12	6
7	FCE 532	Industrial Law and Relations	2	0	0	2
TOTAL			**12**	**4**	**16**	**22**

***Project carries a total of 6 Units spread over the last two semesters of the Final year.**

100 LEVEL ENGINEERING COURSES

ENGINEERING GRAPHICS I (FCE 131)

Course Time table				
Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Engineering Graphics I/FCE 131	Engr. Prof. E. A. Ogbonnaya, Engr. Dr. B. E. Yabefa Engr. B. J. Jonathan	100 Level	First Semester	November, 2022 – March, 2023
Credit Unit: 2	Credit hours: 8	Class Timing: Tuesdays 12pm – 4pm Wednesdays 2pm –		

		6pm

Course Description/Objectives
Drawing in general is an art of picturing an imagination. Thus, engineering drawing is the scientific representation of an object according to standardized requirement. The engineering graphics language had its existence when it became necessary to build new structures and create new machines. The absence of graphics language, the ideas on technical matters have to be conveyed by speech or writing, both are unreliable and difficult to understand in the manufacturing and production industries. It is also may produce lots of manufacturing errors hence, the engineering graphics as a course is aimed to cover these limitations. The importance of engineering drawing cannot be over emphasized, without engineering drawing, it would have been impossible to produce objects like automobiles, machines components, etc. Therefore, the objectives of the course is to hence students with the knowledge of object construction with lay-down engineering principles.

Course Outlines
1. Use of draughting instruments 2. Lettering dimensioning layouts. 3. Constructions of geometrical figures, comics, etc. 4. Graphical calculus and applications. 5. Development, intersection of curves and solids, tangents etc. 6. Projections – Orthographic and Isometrics, sectional views. **Recommended textbooks** 1) "Technical Drawing", by B. A. Ozogu. Sadah Printing and Publishing, Port-Harcourt, Rivers State, Nigeria 2) "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas Publishing House PVT.LTD, Gujurat, India

3) "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Recognize the fundamental concepts of engineering drawing and graphics	Cognitive	2	1	Classwork + Assignment + Test + Attendance
2	Have good knowledge of design and application in solving simple and complex engineering problems	Cognitive	3	2	Classwork + Assignment + Test + Attendance
3	Analyze engineering models for strength and cost production	Cognitive	4	3	Classwork + Assignment + Test + Attendance
4	Show skills of engineering	Cognitive	5	2	Classwork + Assignment + Test +

	objects in actionable solid models for simulation analyses				Attendance

DETAILED LECTURE PLAN			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Use of draughting instruments	1. "Technical Drawing", by B. A. Ozogu. Sadah Printing and Publishing, Port-Harcourt, Rivers State, Nigeria 2. "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas Publishing House PVT.LTD, Gujurat, India
2 – 3	3 - 4	Lettering dimensioning layouts	
4 – 5	5 – 7	Constructions of geometrical figures, comics, etc	
6 – 8	8 – 10	Graphical calculus and applications	
9 – 11	11 – 12	Development, intersection of curves and solids, tangents etc.	
12 – 14	13 – 15	Projections – Orthographic and Isometrics, sectional views	

15	16 – 17	Revision	3. "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India
16	Final Semester Examination		

ENGINEERING GRAPHICS II (FCE 132)

Course Time table				
Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Engineering Graphics II/FCE 132	Engr. Prof. E. A. Ogbonnaya, Engr. Dr. B. E. Yabefa Engr. B. J. Jonathan	100 Level	Second Semester	November, 2022 – March, 2023
Credit Unit: 2	Credit hours: 8	Class Timing: Tuesdays 12pm – 4pm Wednesdays 2pm – 6pm		

Course Description/Objectives

Engineering graphics is a drawing course which enables an effective communication medium in engineering industries to furnish all needed information required for the manufacture and assembly of machine components and parts. It is understood by all with the knowledge of basic engineering principles of drawing. Thus, by this means, the shape, size, finish, colour and the construction of any object is described accurately, corrected and clearly. Hence, engineering graphics II is to enhance students the ability to use pictorial and freehand sketching, architectural drawing, etc.

Course Outlines

1. Pictorial/Freehand sketching
2. Conventional practices.
3. Architectural drawing.
4. Advance topics in auxiliary and sectional views
5. Developments, intersection of surfaces, projections, etc.

Recommended textbooks

4) "Technical Drawing", by B. A. Ozogu. Sadah Printing and Publishing, Port-Harcourt, Rivers State, Nigeria
5) "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas Publishing House PVT.LTD, Gujurat, India
6) "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understanding the basic language of engineering drawing and graphics	Cognitive	2	1	Classwork + Assignment + Test + Attendance
2	Design simple architectural drawings	Cognitive	6	2	Classwork + Assignment + Test + Attendance
3	Analyze engineering drawings using various views	Cognitive	4	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1 – 2	Pictorial/Freehand sketching	1. "Technical Drawing", by B. A. Ozogu. Sadah Printing and
2 – 3	3 - 4	Conventional practices	

4 – 5	5 – 8	Architectural drawing a) Plans b) Views (front, back and sides) c) Structural drawings d) Mechanical and Electrical drawings	Publishing, Port-Harcourt, Rivers State, Nigeria 2. "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas Publishing House PVT.LTD, Gujurat, Indi 3. "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India
6 – 7	9 – 10	Advance topics in auxiliary and sectional views a) Introduction of sectional views b) Full sectioning c) Half sectioning d) Auxiliary sections	
8 – 10	11 – 13	Developments a) Introduction b) Development of objects Cylinder, square prism, polygons Cone, oblique hexagonal pyramid, truncated cone, etc	
11	14	Intersection of surfaces	
12 – 14	15 – 18	Projections a) Orthographic Projections – Introduction First angle projection Third angle projection	

		b) Axonometric Projections – Introduction Axonometric representation Conventional isometric projections Circles and curves drawn in Isometric views c) Oblique Projections – Introduction The axes, chice of angles,	
15	19 – 20	Revision	
16	**Final Semester Examination**		

200 LEVEL ENGINEERING COURSES

ENGINEERING GRAPHICS III (FCE 261)

Course Time table				
Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Engineering Graphics III/FCE 261	Engr. Prof. E. A. Ogbonnaya Engr. Dr. B.	200 Level	First Semester	November, 2022 – March, 2023

	E. Yabefa Engr. B. J. Jonathan			
Credit Unit: 2	Credit hours: 4	Class Timing: Tuesdays 12pm – 2pm Thursday 12pm – 2pm		

Course Description/Objectives
Engineering drawing is a critical aspect of mechanical engineering, as it is the fundamental need to develop the design and assembly of a machine. While the interpretation of a component in terms of sketching can be done in various methods related to descriptive Geometry. The focus of this course is to hence students on presentation drawings of various kinds such as gears, cam profiles, etc. It also enables students on different engineering design drawings.

Course Outlines	
1	Introduction to limits.
2	Fits and tolerance.
3	Surface roughness determinations.
4	Drawing methods for cam profiles.
5	Presentation of types of gears. Drawing of various types of gears.
6	Assembly drawing of elements. Sub-assembly drawing of elements.
7	Workshop drawing correction. Modification of drawings symbols.
8	Reading of blueprints. Geometrical Constructions.

Principles of Tangency. Orthographic Projections. Sectional views. Dimensioning.

Recommended textbooks

1. "Technical Drawing", by B. A. Ozogu. Sadah Printing and Publishing, Port-Harcourt, Rivers State, Nigeria
2. "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas Publishing House PVT.LTD, Gujurat, India
3. "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Define the basis of limits, fits and tolerance	Cognitive	1	2	Classwork + Assignment + Test + Attendance
2	Draw the various methods of cam profiles	Cognitive	6	4	Classwork + Assignment + Test + Attendance
3	Describe the various types of gears and their	Cognitive	4	4	Classwork + Assignment + Test + Attendance

	drawing techniques.				
4	Explain drawing elements and apply CAD in engineering drawing	Cognitive	3	4	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Introduction to limits	1. "Technical Drawing", by B. A. Ozogu. Sadah Printing and Publishing, Port-Harcourt, Rivers State, Nigeria 2. "Engineering Drawing (Plane and Solid Geometry)", by N. D. Bhatt and V. M. Panchal. Charotas
2	2 - 3	Fits and tolerance	
3 – 4	4 – 5	Surface roughness determinations	
5 –6	6 – 11	Drawing methods for cam profiles	
7 – 8	12 – 14	Presentation of types of gears. Drawing of various types of gears	
9 – 10	15 – 17	Assembly drawing of elements. Sub-assembly drawing of elements	

11	18	Workshop drawing correction. Modification of drawings symbols	Publishing House PVT.LTD, Gujurat, India 3. "Machine Drawing", by K. L. Narayana, P. Kannaiah and K. V. Reddy. New Age International Publishers, New Deilhi, India
12	19	Reading of blueprints. Geometrical Constructions. Principles of Tangency	
13	20 – 21	Orthographic Projections.	
14		Sectional views. Dimensioning	
15	22 – 23	Revision	
16	**Final Semester Examination**		

ENGINEERING STATICS (FCE 265)

Course Time table				
Course Title/Code: Engineering Statics/FCE 265	Name of Lecturers: Engr. Prof. A. N. Okpala, Engr. Dr. T. J. Ajoko, Engr. G. Banje	Class Level: 200 Level	Semester: First Semester	Duration: November, 2022 – March, 2023
Credit Unit: 3	Credit	Class Timing:		

	hours: 4	Mondays 12pm – 2pm Wednesdays 12pm – 2pm

Course Description/Objectives

The course teaches students the concept of engineering statics. The student will be introduced to ideas of applied loads in different static engineering materials and the behaviour of the materials under the load application. It teaches load application in equilibrium condition, different kind of force systems on structures like frames, trusses, etc. It also describes the action of shear forces and bending moment on engineering components. This course familiarizes students with the principles of static equilibrium by applying Newton's laws of motion to solve engineering problems. Emphasis is placed on drawing free body diagrams and self-checking strategies.

Course Outlines

1. Apply Newton's laws of motion on problems of engineering statics.
2. Identify the different force action on engineering components.
3. Analyse different force systems, their resultant, magnitude and direction.
4. Determine shear force and bending moment analysis with their corresponding diagrams.
5. Solve simple problems involving friction between surfaces and moment of inertia on plane figure, composite bodies, etc

Recommended textbooks

1. "Engineering Mechanics", by D.S. Kumar. S.K Kataria & Sons Publishers of Engineering and Computer Books, New Delhi, India
2. "Engineering Mechanics – Statics", by E.W. Nelson, C.L. Best, W.G. McLean, M.C. Potter. Tata McGraw Hill

Education Private Limited, New Delhi, India

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Apply Newton's laws of motion on problems of engineering statics.	Cognitive	3	1	Classwork + Assignment + Test + Attendance
2	Describe the concept of mathematical modelling to Engineering problems.	Cognitive	2	1	Classwork + Assignment + Test + Attendance
3	Analyse forces to vertical and horizontal components, define and classify force systems.	Cognitive	4	1	Classwork + Assignment + Test + Attendance
4	Differentiate between shear force and	Cognitive	2	1	Classwork + Assignment + Test +

	bending moments, the types of friction and their application to engineering equipment.				Attendance
5	Calculate problems in moment of inertia for plane figures and composite bodies.	Cognitive	5	1	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1 – 2	Basic Concepts – Newton's Law of Motion a) First Law b) Law of Inertia c) Second Law d) Third Law e) Mathematical Modelling	4. Engineering Mechanics by D.S. Kumar. S.K Kataria & Sons Publishers of Engineering and Computer Books, New
2 – 3	3 - 5	Force Systems i. Colinear force	

		system ii. Coplanar and spatial force system, Non-coplanar force system iii. Parallel and Non-parallel, Like and unlike force systems, etc. iv. Equilibrium Condition and Resultant of forces.	Delhi, India 5. Engineering Mechanics – Statics by E.W. Nelson, C.L. Best, W.G. McLean, M.C. Potter. Tata McGraw Hill Education Private Limited, New Delhi, India
4 – 5	6 – 8	Shear Forces and bending moments in beams and shafts	
6 – 8	9 – 11	Trusses and Frames	
9 – 11	12 – 14	Friction between dry surfaces	
12 – 14	15 – 18	Moment of Inertia, plane figures and composite bodies.	
15	19 – 20	Revision	
16	**Final Semester Examination**		

ENGINEERING DYNAMICS (FCE 262)

Course Time table				
Course	Name of	Class	Semester:	Duration:

Title/Code:	Lecturers:	Level:		
Engineering Dynamics/FCE 262	Engr. Dr. Agonga Oyinbonogha Fred Engr. Dr. Otuami Obiga	200 Level	Second Semester	April, 2023 – July, 2023
Credit Unit: 3	Credit hours: 4	Class Timing: Mondays 12am – 2pm Wednesdays 2pm – 4pm		

Course Description/Objectives
Dynamics is a branch of mechanics that deals with the motion of bodies under the action of forces. The two distinct aspects of dynamics are kinematics and kinetics. In this course the focus will be on 2D dynamics, hence students are expected to learn 2D kinematics and kinematics with adequate attention given to real life application.
Course Outlines
1. Plane kinematics and kinetics of particles. 2. Kinetics of particle; Newton's laws of motion.

3. Work and Energy, conservation of energy and momentum, fields of forces,

4. Impact coefficient of restitution.

5. Kinetics of system of particles.

6. Generalized Newton's second law, steady mass flow and variable mass rocket motion.

7. Plane kinematics and kinetics of rigid bodies.

8. 3D dynamics of rigid bodies, gyroscopic motion and gyroscopic stabilization.

RECOMMENDED TEXTBOOKS

1 Engineering Mechanics Dynamics J.L. Meriam and L.G. Kraige (6th edition)

2 Engineering Dynamics A comprehensive introduction, N. Jeremy Kasdin and Derek A. Paley

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	To understand and analyze 2D kinematics and kinetics dynamics	Cognitive	3	1	Classwork + Assignment + Test + Attendance

	systems.				
2	Application of knowledge of vectors in solving 2D kinematics and kinetics dynamics problems.	Cognitive	2	1	Classwork + Assignment + Test + Attendance
3	To understand the different types of motion, impact and collision	Cognitive	2	1	Classwork + Assignment + Test + Attendance
4	Application of Newton's 2nd Law in solving dynamics problems.	Cognitive	4	1	Classwork + Assignment + Test + Attendance
5	Use of energy method in solving	Cognitive	5	1	Classwork + Assignment + Test + Attendance

	dynamics problems.				

DETAILED LECTURE PLAN

Week No	Lecture	Course Content to be Covered	References
1	1 – 2	BASIC CONCEPTS OF ENGINEERING DYNAMICS • Introduction to engineering dynamic • Define and evaluate basic terms associated with Engineering Dynamics • Kinematics of a particle • Kinetics of a particle • Newton's Laws of motion	1 Engineering Mechanics Dynamics J.L. Meriam and L.G. Kraige (6th edition) 2. Engineering Dynamics A comprehensive introduction, N. Jeremy Kasdin and Derek A.
2 – 3	3 - 5	RECTILINEAR AND CURVILINEAR MOTION • Displacement, velocity and acceleration • Graphical representation • Rectilinear and curvilinear motion • Equations of rectilinear motion • Motion under gravity • Curvilinear motion	
4 – 5	6 – 8	PROJECTILES • Projectile motion • Equations of projectile path	

		• Projection on an inclined plane	
6 – 8	9 – 11	COLLISION OF ELASTIC BODIES • Collision of Elastic Bodies • Types of impact • Elastic and Inelastic impact • Conservation of momentum • Newton's Law of Collision: Coefficient of restitution • Loss of Kinetic energy during impact • Oblique-Central Impact	
9 – 11	12 – 14	KINETICS: IMPULSE MOMENTUM, WORK AND ENERGY	
12 – 14	15 – 18	KINETICS OF ROTARY MOTION	
15	19 – 20	Revision	
16	Final Semester Examination		

FLUID MECHANICS I (FCE 232)

Course Time table				
Course Title/Code: Fluid	Name of Lecturers:	Class Level:	Semester: Second	Duration: April, 2023

Mechanics I/FCE 232	Engr. Dr. Y. P. Olisa Engr. Dr. A. E. Amos Engr. Goodnews Arobe	200 Level	Semester	– July, 2023
Credit Unit: 3	Credit hours: 4	Class Timing: Wednesday 8am – 10am Thursday 10am – 12pm		

Course Description/Objectives
Fundamentals of fluid mechanics introduces students to the basic concept of fluid mechanics such as fluid characteristics, fluid properties, dimensional analysis and unit. It gives the basic principles and theories of fluid static condition and fluid motion. For fluid static, students will understand the pressure, buoyancy forces in submerged bodies and stability of bodies in fluid. Fluid in motion, students are taught the basic laws of conservation of mass, energy and momentum. Bernoulli's equations and momentum equations as application to compressible and incompressible flows. Students will be able to describe and differentiate between a Newtonian and Non-Newtonain fluids, ideal/real friction losses. Students will be introduced to types of flow measurements. Also introduced to analytical application of solving different types of engineering problems.
Course Outlines
1 Introduction to the properties of fluid mechanics (density,

viscosity, etc), fluid characteristics, Newton's law, hydrostatic laws, dimension measurement and units

2 Introduction to pressure and pressure measurement.

3 Introduction and derivation of basic laws, theories and equations fluid flow continuity energy equation and momentum equation as applicable to fluid flow in real and ideal conditions.

4 Application of these laws in solving problems with fluid at rest and in motion.

5 Introduction to fluid flow measurement, pressure, velocity, rate of discharge.

RECOMMENDED TEXTBOOKS

- Fluid Mechanics and Hydraulic Machines by R. K. Rajput.
- Fluid Mechanics by Douglas J. F. Gasiorek, J. M. Swaffield J. A. and Lynn Jack

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Analyse the properties and characteristics of fluid (density, viscosity, etc) Newton's law, hydrostatic laws, dimension	Cognitive	2	2	Classwork + Assignment + Test + Attendance

	measurement and units				
2	analyse pressure and pressure measurement.	Cognitive	3	1	Classwork + Assignment + Test + Attendance
3	Evaluate the hydrostatic forces in fluids	Cognitive	5	1	Classwork + Assignment + Test + Attendance
4	Evaluate the basic laws and principles fluid	Cognitive	3	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Introduction to fundamental concept of fluid mechanics, properties of fluid (viscosity, density, specific gravity).	Engineering Mechanics Dynamics J.L. Meriam and L.G. Kraige (6th edition)
2	3 – 4	Thermodynamic properties – compressibility and Bulk Modulus vapour Pressure	
3	5 - 7	Introduction to pressure/measure, pressure head, Pascal law, absolute,	

		Gauge and atmospheric pressure.	Engineering Dynamics A comprehensive introduction, N. Jeremy Kasdin and Derek A. Paley
4	8 – 9	Use of manometers and mechanical gauges for pressure measurement.	
5	10	Introduction to hydrostatic forces on immersed surfaces.	
6 – 7	11 – 12	Horizontal and vertical induced surfaces application for problem solving.	
8 – 9	13 – 14	Introduction to Buoyancy condition of bodies in fluid stability, meta centre, meta-centre height application in solving problems.	
10 – 11	15 – 16	Introduction to fluid types and flows, steady/unsteady, uniform/non-uniform, one, two, three-dimensional flow, rotational/irrotational flow, laminar/turbulent flow, compressible/incompressible flow.	
12 – 13	17 – 19	Fluid dynamics, different heads, derivation of Bernoulli's Euler's Equations for ideal and real fluid.	
14	20	Derivation of momentum equation, application to fluid measurement (flow rate,	

		velocity, pressure)	
15	21 – 22	Revision	
16	Final Semester Examination		

WORKSHOP TECHNOLOGY (FCE 263)

Course Time table				
Course Title/Code: Workshop Technology (FCE 263)	Name of Lecturers: Engr. Dr. K, Kotingo Engr. Dr E. Amula	Class Level: 200 Level	Semester: First Semester	Duration: April, 2023 – July, 2023
Credit Unit: 3	Credit hours: 4	Class Timing: Monday 10pm – 12pm Friday 12pm – 2pm		

Course Description/Objectives
The course introduces students to the various manufacturing processes, types of patterns and pattern making, molding sand and sand casting operations ,welding processes and various metal forming operations, measuring instruments, forging operations and carpentry and joinery as well as industrial safety and good house-keeping

practices

Course Outlines

1 Types of pattern and pattern making, molding sand, molding process; machine molding.

2 Ferrous and non-ferrous casting, sand casting, and casting defects.

3 Arc and gas welding processes, soldering and brazing.

4 Introduction to lathe; milling, shaping, cutting and drilling operations. Cutting fluids.

5 Carpentry and joinery processes. Forging, Industrial safety, good house-keeping.

Recommended textbooks

1) A Textbook Of Workshop Technology (Manufacturing Processes) By R.S Khurmi And J.K Gupta.
2) B.S Raghuwanshi (2011) Workshop Technology. Vol 11 (Machine Tools)

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Identify the principles of pattern making, molding sand, manufacturing processes and metal forming	Cognitive	2	2	Classwork + Assignment + Test + Attendance

	processes.				
2	Description of the fundamentals of production parts by casting techniques, sand casting outlines, ferrous and non-ferrous castings	Cognitive	3	1	Classwork + Assignment + Test + Attendance
3	Evaluation of the Industrial safety practices, good house keeping, carpentry	Cognitive	5	1	Classwork + Assignment + Test + Attendance
4	Application of cutting fluids, introduction to lathe machine	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Description of forging, engineering measurement, gauging, joinery.	Cognitive	3	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Introduction to industrial safety, PPE, carpentry and joinery	(1) B.S Raghuwanshi (2011) Workshop Technology.Vol 11 (Machine Tools) (2)A Textbook Of Workshop Technology (Manufacturing Processes) By R.S Khurmi And J.K Gupta.
2	2 - 3	The Study of patterns, types of patterns and pattern making	
3	4	The Study of foundry tools, molding and sand molds	
4	5	Introduction to lathe and working principles, milling and cutting	
5	6	Introduction to arc and gas welding processes, soldering, slotting	
6	7 – 9	Cutting fluids and types of cutting fluids	
7 – 9	8 – 12	Casting defects, forging	
10 – 11	13 – 15	Engineering measurements	
12 – 13	16 – 18	Test/continuos assessment	
14	19 – 20	Practical Section	

15	21 – 22	Revision	
16	**Final Semester Examination**		

EEE 231 Introductions to Computer Engineering

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
Introduction to Computer Engineering (EEE 231)	**Tony Miebi**	**200 Level**	**First Semester**	**November, 2022 – March, 2023**
Credit Unit: 2	**Credit hours: 4**	**Class Timing: Thursdays 2.00 pm – 4.00 pm**		

Course Description/Objectives
The course is intended to introduce students to the concept of programming, and afterwards take them through terms, principles, and techniques associated with writing programs in C, which is the chosen language. The main thrust of the course is to, through practical examples in class, laboratory sessions, and assessment exercises, provide students the opportunity of mastering through C, the techniques of: 1. Writing procedural programs. 2. Providing multiple pathways to solutions through branching

and selection.

3. Writing programs with solutions based on looping/iterating.

Course Outlines

6 Reading data from keyboard
7 Math functions
8 Formatting program output
9 Relational & equality operators
10 Logical operator
11 Branching/selection
12 Increment and decrement operators
13 Looping/iterating

Recommended textbooks

3) C - How to Program by P. Deitel and H. Deitel
4) Programming with C by R.S. Bichkar
5) C Programming: The Tutorial by Thomas Gabriel

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand what the fundamental concept of programming is.	Cognitive	1	1	Classwork + Assignment + Attendance
2	Know the types data, how they are stored,	Cognitive	2	2	Classwork + Assignment + Test + Attendance

	written to screens, and read from keyboards.				
3	Understand arithmetic operators and math functions in C, and know how to use them in writing programs	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Know equality, relational, and logical operators and the concept of short-circuit evaluation	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Understand how to use the techniques of branching and looping in writing programs	Cognitive	5	3	Classwork + Assignment + Attendance

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1	1	Foundational concepts and terms of programming, Basic types of data in C	1. C - How to Program by P. Deitel and H. Deitel 2. Programming with C by R.S. Bichkar 3. C Programming : The Tutorial by Thomas Gabriel
2	2	Basic C program template, Displaying data	
3	3	Comments in C, Names and identifiers, Variables, Arithmetic operators	
4	4	Assignment operators, Reading data from keyboard	
5	5	Math functions	
6	6	Formatting program output, Relational & equality operators	
7	7	Logical operator: Short-circuit evaluation	
8-9	8-9	Branching/selection	
10-12	10-12	Increment and decrement operators, Looping/iterating	
13-14	13-14	Revision	
15	15 – 16	Test	

16	Final Semester Examination

EEE 234 Data Structures and Algorithms

Course Time table				
Course Title/Code: **Data Structures and Algorithms (EEE 234)**	**Name of Lecturers:** **Tony Miebi**	**Class Level:** **200 Level**	**Semester:** **Second Semester**	**Duration:** **April, 2023 – July, 2023**
Credit Unit: 2	**Credit hours: 4**	**Class Timing: Mondays 2.00 pm – 4.00 pm** **Fridays, 12.00 pm – 2.00 pm**		

Course Description/Objectives
The course begins with the introduction of the concept of data structures, and the concept of algorithms in programming. Developing user-defined functions then follows, since it is what will constitute algorithms that will be implemented later. Arrays are then introduced as the first data structure. Algorithms are designed and implemented to cover various array operations, covering single dimensional arrays (vectors) and two-dimensional arrays (matrixes). The course then introduces the students to the concepts of concept of pointers, strings, enumeration constants, and structures/aggregates as tools for creating user-defined data types in C. The course afterwards proceeds to cover the implementation and usage of linked lists as a flexible alternative to

arrays.

Course Outlines

14 Introduction to data structures and algorithms
15 Creating user-defined functions
16 Random number generation
17 One-dimensional arrays and its operations
18 Two-dimensional arrays and its operations
19 Pointers
20 Strings
21 Enumeration constants
22 Structures/Aggregates
23 Dynamic memory allocation
24 Linked lists and its operations.

Recommended Texts

1. How to Program by P. Deitel and H. Deitel
2. Programming with C by R.S. Bichkar
3. C Programming: The Tutorial by Thomas Gabriel

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand the concept of data structures, algorithms, factors considered when discussing the efficiency of an algorithm.	Cognitive	1	1	Classwork + Assignment + Attendance

2	Know how to implement and use user-defined functions, both directly and through custom header files.	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Understand single and multidimensional arrays and how they are used	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Understand the concept of pointers strings, and structures	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Understand the defining and usage of linked lists.	Cognitive	5	3	Classwork + Assignment + Attendance

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Introduction to data structures and algorithms User-defined function: structure, implementation, positioning, recursion vs	4. C - How to Program by P. Deitel and H. Deitel

		iteration, custom headers	5. Programming with C by R.S. Bichkar
3 – 5	5 - 10	Random number generation: avoiding repetition through proper seeding One-dimensional array: Definition, element referencing, processing with loops, operations	6. C Programming: The Tutorial by Thomas Gabriel
6 - 7	12 – 14	Two-dimensional arrays and operations	
8 – 9	15 - 18	Pointers. Strings	
10	19 – 20	Enumeration constants. Structures/aggregates	
11 – 12	21 – 24	Dynamic memory allocation. Linked list and its operations	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 211: Circuit Theory I

Course Time table

Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Circuit theory I (EEE 211)	**Engr. Dr. Priye Kenneth Ainah**	**200 Level**	**First Semester**	**November 2023 – March, 2023**

Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 10am – 12pm** **Tuesday 2pm – 4pm**

Course Description/Objectives
The objective of the course is to understand the basic concept of electrical circuit theory such as the laws and theorems to solve simple engineering circuit. The study will also deal with measurement principle and operational amplifier circuit.
Course Outlines
1 Fundamentals of electrical engineering units 2 Circuit elements, circuit laws, Ohm's law, Kirchhoff's Laws, voltage and current division. 3 measurement principles, mesh and node equations, network theorems,

4 operational amplifier circuits,
5 energy storage elements, sinusoids and phasors,
6 sinusoidal steady state analysis, average and RMS values, complex power.
7 Theremin and Norton equivalents, power calculation to basic DC and AC circuits. MATLAB,
8 Basic circuit analysis with MATLAB.

Recommended textbooks

1 Circuit Analysis with Devices. Theory and Practice. 3rd Edition by Allan H. Robbins and Wilhenlm C. Miller. Demar Cengage Learning, 2003
2 Electrical Circuit Theory and Technology 3rd Edition by John Bird. Newnes, 2007.
3 Circuit Analysis and feedback Amplifierr Theory by Wai-Kai Chen. Taylor and Francis 2006.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Discuss the fundamental concepts of electricity and electrical D.C. circuits;	Cognitive	2	2	
2	state, explain and apply the basic D.C circuit	Cognitive	2	1	Classwork + Assignment + Attendance

	theorems;				
3	Explain the basic a.c. circuit theory and	Cognitive	5	2	Classwork + Assignment + Attendance
4	Apply to solution of simple circuits.	Cognitive	5	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Introduction to the fundamentals of electrical engineering units	1 Circuit Analysis with Devices. Theory and Practice. 3rd Edition by Allan H. Robbins and Wilhenlm C. Miller. Demar Cengage Learning, 2003 2 Electrical Circuit Theory and Technology
2	2		
3	3-4	Circuit elements, circuit laws, Ohm's law, Kirchhoff's Laws, voltage and current division.	
4	4-6	Measurement principles, mesh and node equations, network theorems,	
5	7	Operational amplifier circuits	
6	8	Energy storage elements, sinusoids and phasors	

7 – 9	8 – 11	Sinusoidal steady state analysis, average and RMS values, complex power	3rd Edition by John Bird. Newnes, 2007. 3 Circuit Analysis and feedback Amplifierr Theory by Wai-Kai Chen. Taylor and Francis 2006..
10 – 11	12 – 15	Thevenin and Norton equivalents, power calculation to basic DC and AC circuits. MATLAB,	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 212: Circuit Theory I

Course Time table				
Course Title/Code: **Circuit theory II (EEE 212)**	**Name of Lecturers:** **Engr. Dr. Priye Kenneth Ainah**	**Class Level:** **200 Level**	**Semester:** **Second Semester**	**Duration:** **April 2023 –July, 2023**
Credit Unit:	**Credit hours:**	**Class Timing: Tuesday 10am –**		

3	**4**	**12pm** **Thursday 2pm – 4pm**

Course Description/Objectives
The objective of the course is to understand the basic concept of electrical circuit theory such as the laws and theorems to solve simple engineering circuit. The study will also deal with measurement principle and operational amplifier circuit.
Course Outlines
1. Basic RL and RC, transient analysis to find solutions to time-varying currents and voltages, circuit time constants, 2. Natural and forced response, effect of initial conditions. RLC circuits, characteristic equation, definition of frequency terms, e.g., damping coefficient, resonant frequency, 3. Over damped, critically damped, and under-damped response complete response (natural plus forced). Sinusoidal Steady-State Analysis of RLC Circuits, characteristics of sinusoids, phasors, and phasor relationships for RLC, 4. Impedance, Admittance, Node and Mesh Analysis, Superposition, Circuit Theorems, Phasor Diagrams. 5. Single-phase steady state AC power circuit analysis, effective (RMS) values, real and reactive power, complex power, Power factor, Maximum power transfer. Polyphase, Balanced three-phase circuits, 6. Three-phase circuits and loads, Delta and Wye configurations/conversions, three-phase power calculations. Magnetically coupled circuits, Mutual and self-inductance, magnetic coupling, linear coupled coils and “Dot” convention,

7. linear transformers/reflected impedance, Ideal transformers/impedance matching. Resonance and frequency response,
8. Parallel and series resonance, Frequency response, Bandwidth and quality factor, Bode plots, Complex frequency and the Laplace transform,
9. Background and definitions, Step and impulse functions, Functional transform computation, operational transforms, Inverse Laplace transform computations. Circuit analysis in the Laplace-domain, Circuit analysis in the s-domain, Impulse response. MATLAB exercises..

Recommended textbooks

1 Circuit Analysis with Devices. Theory and Practice. 3rd Edition by Allan H. Robbins and Wilhenlm C. Miller. Demar Cengage Learning, 2003

2 Electrical Circuit Theory and Technology 3rd Edition by John Bird. Newnes, 2007.

3 Circuit Analysis and feedback Amplifierr Theory by Wai-Kai Chen. Taylor and Francis 2006.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	write circuit equations for a coupled-inductor system;	Cognitive	4	3	Classwork + Assignment + Attendance
2	analyse circuits containing ideal	Cognitiv	3	1	Classwork +

	transformers and autotransformers ;	e			Assignment + Attendance
3	analyse three-phase wye- and delta-connected balanced circuits;	Cognitive	5	2	Classwork + Assignment + Attendance
4	plot Bode diagrams from transfer functions for SISO circuits; RLC, Impedance, Admittance	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	write behavioural descriptive equations for series- and parallel-resonant circuits in the time- and frequency domains;	5	3		
6	use Fourier series techniques to analyse circuit responses to periodic signals;	Cognitive	3	1	

7	derive two-port parameters of circuits.	Cognitiv e	3	2	

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Basic RL and RC, transient analysis to find solutions to time-varying currents and voltages, circuit time constants,	1 Circuit Analysis with Devices. Theory and Practice. 3rd Edition by Allan H. Robbins and Wilhenlm C. Miller. Demar Cengage Learning, 2003 2 Electrical Circuit Theory and Technology 3rd Edition by John Bird. Newnes, 2007. 3 Circuit Analysis and feedback Amplifierr Theory by Wai-Kai Chen. Taylor and Francis
2	2	RLC circuits, characteristic equation, definition of frequency terms	
3	3-4	Impedance, Admittance, Node and Mesh Analysis, Superposition, Circuit Theorems, Phasor Diagrams.	
4	4-6	Single-phase steady state AC power circuit analysis, effective (RMS) values, real and reactive power, complex power, Power factor, Maximum power transfer. Polyphase, Balanced three-phase circuits,	
5	7	Delta and Wye configurations/conversions,	

		three-phase power calculations.	2006.
6	8	Magnetically coupled circuits, Mutual and self-inductance, magnetic coupling, linear coupled coils and "Dot" convention, linear transformers/reflected impedance, Ideal transformers/impedance matching	
7 – 9	8 – 11	Parallel and series resonance, Frequency response, Bandwidth and quality factor, Bode plots, Complex frequency and the Laplace transform,	
10 – 11	12 – 15	Background and definitions, Step and impulse functions, Functional transform computation, operational transforms, Inverse Laplace transform computations. Circuit analysis in the Laplace-domain, Circuit analysis in the s-domain, Impulse response. MATLAB exercises..	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	

	Final Semester Examination

300 LEVEL ENGINEERING COURSES

EEE 321: Measurement and Instrumentation

Course Time table				
Course Title/Code: Measurement and Instrumentation (EEE 321)	**Name of Lecturers: Engr. Dr. Ayibapreye Kelvin Benjamin**	**Class Level: 300 Level**	**Semester: First Semester**	**Duration: November, 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 12am – 2pm Friday 10pm – 12pm**		

Course Description/Objectives
The objective of the course is to educate the students on the principles and theories governing electrical measurements and measuring instruments. This will help to outline the categories and classification of measuring instruments and to explain which instrument is used for measuring various electrical and electronic quantities. There is need to explain to the students about the essential features that are needed for proper operations of different classification of measuring instruments: deflecting, controlling and damping torques and the principles behind their operations. Systematic analysis of the operation of different classes of instruments for measurement of current, voltage, power,

energy, and non-electrical quantities such as temperature, displacement, force, etc. To explain how these instruments are connected in circuits to measure the various quantities. A good understanding of this course will prepare the students for future practice as engineers whether in academics or in the industry. It will give the students a good foundation in the handling and uses of all electrical instruments. It will also equip the students with the basic knowledge and ability necessary to analyze and solve real life problems using the various types of electrical instruments.

Course Outlines

1. Definitions and examples of measurements and their limitations: resolution, accuracy, sensitivity.
2. Noise in electronic systems, analogue, digital and sampling oscilloscopes.
3. DC and AC bridges. Amplifiers: Sampling and analogue to digital conversion, Oversampling, oscillators and synthesizers.
4. Units of measurement, measuring instruments and their calibration.
5. Recording instruments and their application.
6. Errors in measurement, Measurement of Voltage waveforms phase and frequency measurements.
7. Phase noise, network and spectrum analysis

Recommended textbooks

1 Electrical and Electronic Measurements and Instrumentation, Er. K.R. Rajput, Chand (S.) & Co Ltd, India, First Edition, January 1, 2008.

2 Fundamental of Electrical Engineering, Charles A. Gross and Thaddeus A. RoppeL CRC Press; 1st edition February 2012

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Understand the use of measuring	Cognitive	2	2	Classwork +

	instruments for measuring electrical quantities, and should be able to distinguish between various types of measuring instruments.				Assignment + Attendance
2	Understand measurements of current and voltages using ammeters, voltmeters, galvanometers, potentiometers and the basic principles, the various types, operation and characteristics of the most two most widely used devices: the permanent magnet moving coil instrument (for DC) and the moving iron instrument (for AC and DC).	Cognitive	2	1	Classwork + Assignment + Attendance
3	Understand power measurement using wattmeter, the various types and basic principles of operation. Details of dynamometer moving coil	Cognitive	5	2	Classwork + Assignment + Attendance

	instruments, construction, operation, and deflection torque.				
4	Identify an energy meter, The watt-hour meter-construction/operation, counting mechanism, meter constant.	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Understand the measurement of resistance using the Wheatstone meter bridge, ohmmeter, megger, voltmeter-ammeter methods, the use of multimeter as voltmeter, ammeter and ohmmeter, digital multimeter.	Cognitive	4	3	Classwork + Assignment + Attendance
6	Solve engineering problems: Application of transducers-aircraft/boat rubber, thermocouple, communication transducers-microphones, pick-ups, loudspeakers, headphones, telephone handset and measurements	Cognitive	5	3	Classwork + Assignment + Test + Attendance

	using cathode ray oscilloscope (CRO), building blocks, controls, etc. Display of signal waveform on the screen.				

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	BASIC PRINCIPLES ✓ Understand measurement of electrical quantities. ✓ Understand the classification of instruments and essential features of indicating instruments. ✓ Understand methods of producing deflecting, controlling and damping torques.	(1) Electrical and Electronic Measurements and Instrumentation, Er. K.R. Rajput, Chand (S.) & Co Ltd, India, First Edition, January 1, 2008. (2) Fundamental of Electrical Engineering, Charles A. Gross and Thaddeus A. RoppeL CRC Press; 1st edition February 2012
2	2	MEASUREMENT OF CURRENT AND VOLTAGES ✓ Ammeters and Voltmeters, basic principles, the various types. ✓ Details of construction, operation and characteristics of	

		two most widely used devices: the permanent magnet moving coil instrument (for dc) and the moving iron instrument (for ac and dc)	
3	3	MEASUREMENT OF POWER ✓ The wattmeter, basic principles, the various types. Details of dynamometer moving coil instrument– construction, operation, deflecting torque. Wattmeter connections -dc, single phase, three phase ac systems.	
4	4	MEASUREMENT OF ENERGY ✓ The watt-hour meter – construction/operation, counting mechanism, meter constant.	
5	5-6	MEASUREMENT OF RESISTANCE ✓ The Wheatstone bridge, ohm meter, Megger, voltmeter – ammeter, methods.	
6	7	The Multimeter – use as voltmeter, ammeter and ohm meter, digital multimeters.	

7 – 9	8 – 11	OSCILLIOSCOPES ✓ The cathode ray oscilloscope (CRO), building blocks, controls, etc. ✓ Display of signal waveform on the screen, role of saw-tooth generator, trigger circuit. ✓ Measurements using the CRO – voltage, frequency, phase angle, Lissajous figures.	
10 – 11	12 – 15	Solve engineering problems. ✓ Application of transducers- aircraft/boat rubber, thermocouple, communication transducers- microphones, pick-ups, loudspeakers, headphones, telephone handset	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 335: Introduction to Operating System: (3 Units).

Course Time table				
Course Title/Code: Introduction to Operating system /EEE 335	Name of Lecturers: Ebipuado Sapre-Obi	Class Level: 300 Level	Semester: First Semester	Duration: November, 2022 – March, 2023
Credit Unit: 3	Credit hours: 8	Class Timing: Wednesdays 8am – 10am		

Course Description
An operating system defines an abstraction of hardware and manages the sharing of computing resource among the computer users. This course covers developing key approaches to operating system design and implementation. From basic structure to synchronization, overview of monolithic, micro and hybrid kernel types, implementation of file, processes, memory organization and Network management. Kernel subsystems will be discussed in detail.
Course Outline
- This course will cover the following topics: - Introduction to Operating System. - File Management

- Input / Output Handling
- File Locking
- Process Management
- Daemon Process
- Timers, Resource Limits and Log Messages
- Linux Thread Basics
- Signaling Mechanisms
- Memory Management
- Primitive Inter Process Communications
- Socket Programming

Recommended Textbook

1. Operating System Concepts by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Eighth edition, John Wiley & Sons. Inc, 2009.

2. Linux System Programming by Robert Love, O'Reilly Media, 2013.

3. Operating Systems three easy pieces by Remzi Arpaci-Dusseau, Andrea C. Arpaci-Dusseau Arpaci-Dusseau Books Inc, 2014

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Learn the fundamental concepts of Operating systems	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have a good understanding	Cognitive	2	2	Classwork +

	of processes and thread				Assignment + Test + Attendance
3	Able distinguish between various types of operating systems, eg ROS, RTOS etc	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Understand OS Kernel, deadlocks Semaphores Stacks and inter-process communication	Psychomotor	5	3	Classwork + Assignment + Test + Attendance
5	Hands-on exercise on Linux Kernel programming	Psychomotor	5	3	Classwork + Assignment + Attendance

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Introduction to operating systems, a. Features	• "Operating System

		b. Layered Approach c. Kernel Functionality d. Different types of Kernel –Monolithic, Micro and Hybrid e. Booting Procedure	Concepts by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Eighth edition, John Wiley & Sons. Inc, 2009. • "Linux System Programming by Robert Love, O'Reilly Media, 2013. • "Operating Systems three easy pieces by Remzi Arpaci-Dusseau, Andrea C. Arpaci-Dusseau Arpaci-Dusseau Books Inc,
2 – 3	3 - 4	File Management a. File Tree Structure b. File Types c. File System d. Ext4/XFS e. Device Special Files	
4 – 5	5 – 7	I/O Handling a. overview b. fd table c. System Calls d. Opening a file e. Duplicating a file descriptor f. Random Access g. File control h. Get file status i. Select system call	
6 – 8	8 – 10	File Locking a. Types of file locking b. flock structure c. Pseudo Code for write lock	
9 – 10	11 – 12	Process Management a. mode and space b. Context switch c. Process objects d. Execution Context e. Process structure f. Process states g. Process scheduling h. Process Creation – fork Library functions	
11-12	13-14	Daemon Process a. Characteristics b. Example Program Timers, Resource Limits and Log Messages a. Time Zone b. Alarm c. Interval Timers d. Set and Get Timers e. Time Stamp Counter f. Hard and Soft Resource Limits g. Set and Get Limits h. syslog	

		Linux Thread Basics a. overview b. User Level Thread c. Kernel Level Thread d. Example Program	2014 • The C Programming by Brian Kernighan and Dennis Ritchie 2nd edition 1978
13–14	15 – 16	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 302: MATLAB for Electrical Engineers

Course Time table				
Course Title/Code: MATLAB for Electrical Engineers (EEE 302)	**Name of Lecturers:** **Engr. Dr. Ayibapreye Kelvin Benjamin**	**Class Level:** **300 Level**	**Semester:** **Second Semester**	**Duration:** **February, 2023 – June, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 8am – 10am** **Friday 4pm – 6pm**		

Course Description/Objectives
The objective of the course is to establish and educate the students on the use of MATLAB computing software in solving electrical

engineering problems. Students will learn how to use the MATLAB environment which comprises the MATLAB window, the command window, current directory, work space and command history. Students will learn how to start MATLAB, use MATLAB as a calculator, quit MATLAB, create MATLAB variables, overwrite variable and correct syntax errors. Controlling of the hierarchy of operations or precedence and the appearance of floating-point number is important in MATLAB programming, Students will learn how to manage the workspace, keeping of the work session, entering of multiple statements per line, use of miscellaneous commands and getting MATLAB help. The use of mathematical functions, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line style and colours are important aspects of this course. Matrix generation and manipulations, array operations and linear equations, introduction to programming in MATLAB, control flows and operations, debugging M-files and the use of MATLAB to solving engineering problems: signals and systems, communication systems, Fourier transform, Z-transform, Basic filter analysis and design, electromagnetic field problems.

Course Outlines

1. MATLAB fundamentals and their applications.
2. Circuit analysis
3. Signals and systems
4. Communication systems
5. Fourier transforms and Z-transforms
6. Basic filter analysis and design
7. Electromagnetic Field Problems

Recommended textbooks

1 MATLAB for Engineering Applications, William Palm, Fourth Edition, McGraw Hill, February 6, 2018

2 MATLAB for Engineers, Sixth Edition, Holly Moore, Salt Lake Community College Pearson Education Inc, 2022.

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Understand the use of MATLAB environment which comprises the MATLAB window, the command window, current directory, work space and command history	Cognitive	2	2	Classwork + Assignment + Attendance
2	Understand the use of MATLAB as a calculator, quit MATLAB, create MATLAB variables, overwrite variable and correct syntax errors	Cognitive	2	1	Classwork + Assignment + Attendance
3	Understand the control of the hierarchy of arithmetic & logic operations or	Cognitive	5	2	Classwork + Assignment + Attendance

	precedence and the appearance of floating-point number is important in MATLAB programming, manage the workspace, keeping of the work session, entering of multiple statements per line, use of miscellaneous commands and getting MATLAB help.				
4	Identify mathematical functions, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line style and colours.	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Understand Matrix generation and	Cognitive	4	3	Classwork + Assignment

	manipulations, array operations and linear equations, introduction to programming in MATLAB, control flows and operations, debugging M-files.				+ Attendance
6	Solve engineering problems: signals and systems, communication systems, Fourier transform, Z-transform, Basic filter analysis and design, electromagnetic field problems	Cognitive	5	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Getting started with MATLAB ✓ Understand the use of MATLAB environment	(1) MATLAB for Engineering Applications, William Palm,

		✓ Understand the use of MATLAB as a calculator ✓ Understand how to quit MATLAB, and create MATLAB variables. ✓ Understand how to overwrite variable and correct syntax errors.	Fourth Edition, McGraw Hill, February 6, 2018 (2) MATLAB for Engineers, Sixth Edition, Holly Moore, Salt Lake Community College Pearson Education Inc, 2022.
2	2	✓ Understand the control of the hierarchy of arithmetic & logic operations or precedence and the appearance of floating-point number is important in MATLAB programming, ✓ Manage the workspace, keeping of the work session, entering of multiple statements per line, use of miscellaneous commands and getting MATLAB help.	
3	3	Matrix generation and manipulations ✓ Understand entering a vector and entering a matrix. ✓ Understand matrix indexing, colon operator, linear spacing, colon operator	

		in MATRIX, creating a sub-matrix. ✓ Deleting row or column, dimension, continuation, transposing a matrix, matrix generators and special matrices.	
4	4	Array operations and linear equations: ✓ Matrix arithmetic operations ✓ Array arithmetic operations	
5	5-6	Introduction to programming in MATLAB ✓ M-Files ✓ Script side effects ✓ Anatomy of a M-file function ✓ Input and output arguments	
6	7	Input to a script file and output commands	
7 – 9	8 – 11	Control flows and operations and debugging M-files. ✓ To understand the if end structure ✓ To understand relational and logical operators. ✓ To understand the for end loop. ✓ To understand the while end loop and	

		other flow structures. ✓ To understand operator precedence.	
10 – 11	12 – 15	Solve engineering problems. ✓ Signals and systems ✓ Communication systems. ✓ Fourier transform. ✓ Z-transform. ✓ Basic filter analysis and design, electromagnetic field problems	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 371 Electrical Machines 1

Course Time table				
Course Title/Code: **Electrical Machines I (EEE 403)**	**Name of Lecturers:** **Engr John Tarilayon Afa**	**Class Level:** **300 Level**	**Semester:** **First Semester**	**Duration:** **November, 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 8 am – 10am**		

		Thursdays, 8am – 10am

Course Description/Objectives
The course is focus on magnetic field, fundamental of electromechanical energy conversion, rotating machines and transformer. The course also discusses DC machines and its characteristics.
Course Outlines
1. introduction to Magnetic circuits, hysteresis, and sinusoidal excitation, magnetization of permanent magnets, approximated design of permanent magnets, and permanent magnet materials. 2. Fundamentals of electro mechanical energy conversion: energy conversion process, field energy. 3. mechanical force in the electromagnetic system, rotating machines and cylindrical machines. 4. Transformers, Rotating magnetic fields and machines, ideal and actual, transformer: equivalent circuits, and, analysis of transformer. Auto-transformers, and three-phase transformers. 5. Design, construction and characteristics of DC Machines **Recommended Texts** 1. Electrical Machines, Drives, and Power Systems Fifth Edition by THEODORE WILDI 2. Principle of Electrical Machines and power electronic by P. C. Sen

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	explain operating principles of fundamental components of Electric Machines: motors, generators and transformers	Cognitive	2	1	Classwork + Assignment + Attendance
2	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	Cognitive	5	2	Classwork + Assignment + Test + Attendance

	transformers;				
3	.Analyse the equivalent circuit of the transformer	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	analyse voltage-current characteristics, commutation of DC generators, torque speed characteristics and speed regulation of DC motors	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Solve problem involving transformer design and generator.		5	3	Classwork + Assignment + Test + Attendance

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Introduction to Magnetic circuits, hysteresis, and sinusoidal excitation, magnetization of permanent magnets, approximated design of permanent magnets, and	1. Electrical Machines, Drives, And Power Systems Fifth Edition by

		permanent magnet materials.	THEODORE WILDI 2. Principle of Electrical Machines and power electronic by P. C. Sen
3 – 5	5 - 6	Fundamentals of electro mechanical energy conversion: energy conversion process, field energy.	
6 - 7	7-8	Mechanical force in the electromagnetic system, rotating machines and cylindrical machines.	
8 – 9	9-10	Transformers	
10	11	equivalent circuits, and, analysis of transformer.	
11 – 12	12	Design, construction and characteristics of DC Machines	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 314: Electromagnetic Field Theory 1

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**

Electromagnetic Field Theory 1 (EEE 314)	**Engr. Dr. Ayibapreye Kelvin Benjamin**	**300 Level**	**Second Semester**	**April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 8am – 10am** **Friday 4pm – 6pm**		

Course Description/Objectives
The objective of the course is to establish and educate the students on the concept of electromagnetic field theory and its applications. Coulomb's law, Faraday's law, Ampere's law, Gauss's laws for electric and magnetic fields are fundamental to the establishment of Maxwell's Equation. The students are taught the connection between these laws. Maxwell's Equation governs the behaviour of Electromagnetic waves in free space and other material media, hence, its important for students to have knowledge of the electrical and magnetic properties of these material media. The concept of vector analysis helps in obtaining the wave equation from Maxwell's equation which thus creating boundary value problems in the form of Laplace's and Poisson's equation. Students are expected to be able to solve problems associated with electromagnetic field, electrostatic charge distributions, electric and magnetic fields at the end of this study.

Course Outlines

1. Introduction to electromagnetic field theory and its application.
2. Coulomb's law and Electrostatic charge distribution
3. Electrical and Magnetic Fields
4. Scalar potentials and boundary value problems
5. Laplace's and Poisson's Equation
6. Electric and magnetic materials
7. Vector analysis and Maxwell's Equation

Recommended textbooks

1 Engineering Electromagnetics, Nathan Ida, Second Edition, 2004 Springer-Verlag New York, LLC.

2 Electromagnetic Field Theory Fundamentals, Bhag Singh Guru and Huseyin Hiziroglu, Second Edition, Cambridge.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Understand the concept of electric and magnetic fields, charge distributions and electrostatics.	Cognitive	2	2	Classwork + Assignment + Attendance
2	Identify that Coulomb's law, Faraday's laws,	Cognitive	2	1	Classwork + Assignment

	Gauss's laws for electric and magnetic fields, modified Ampere's law with the displacement current density are the laws the established Maxwell's Equation.				+ Attendance
3	Determine the Corollary conditions of Maxwell's Equations and the Wave Equations for electric and magnetic fields.	Cognitive	5	2	Classwork + Assignment + Attendance
4	Analyse electromagnetic wave propagation through free space and different material media	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Analyse scalar potentials, boundary value problems, Laplace's and	Cognitive	4	3	Classwork + Assignment +

	Poisson's equations				Attendance
6	Solve simple problems on wave propagation using Maxwell's equations.	Cognitive	5	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Vector Algebra ✓ Understand Scalars and Vectors ✓ Understand Product of Vectors ✓ Understand Definition of Fields, System of coordinates and Coordinate transformation. ✓ Understand Position Vectors	1) Engineering Electromagnetics, Nathan Ida, Second Edition, 2004 Springer-Verlag New York, LLC. (2) Electromagnetic Field Theory Fundamentals, Bhag Singh Guru and Huseyin Hiziroglu, Second Edition, Cambridge.
2	2	Vector Calculus ✓ Understand Integration of Scalar	

		and Vector Functions, differentiation of Scalar and Vector Functions. ✓ Analyse Conservative and Nonconservative Fields, Null Vector Identities and Classification of Vector Fields. ✓ Solve question on Vector Calculus.	
3	3	Coulomb's law, Gauss's law, Electric field and Electric field potential. ✓ Understand charge and charge density, Coulomb's law, electric field intensity, electric flux density and applications. ✓ Understand the electrostatic field, Gauss's law, the electric potential, materials in electric field, interface conditions, capacitance, energy in the electrostatic field: point and distributed charges, Applications.	

		✓ Boundary Value Problems: Analytical Methods of Solution, Poisson's Equation for the Electrostatic field, Laplace's Equation for the Electrostatic field ✓ Solution methods and Image methods.	
4	4	Boundary value problems: Numerical (Approximate) Methods	
5	5-6	The Steady Electric Current and Static Magnetic Field ✓ Analyse conservation of charge, conductors, dielectrics, lossy dielectrics, Ohm's law, power dissipation, Joule's law, the continuity equation, Kirchoff's current law, current density as a field, interface conditions for current density. ✓ Solve magnetic field problems, field intensity, magnetic flux density, the Biot-Savart law, Ampere's	

		law, magnetic properties of materials, forces in magnetic fields, faraday's law, Lenz's law, induced electromotive force (emf).	
6	7	Maxwell's Equations	
7 – 9	8 – 11	Introduction to Electromagnetic Field ✓ To understand Maxwell's Equation, time-dependent potential functions. ✓ Understand interface conditions for the electromagnetic field ✓ To understand particular forms of Maxwell's Equation ✓ To understand the electromagnetic wave equation and its solution.	
10 – 11	12 – 15	The electromagnetic spectrum , poynting theorem, electromagnetic power density, propagation of plane waves.	
12 – 13	16 – 18	Test/continuous assessment	

15	21 – 22	Revision	
	Final Semester Examination		

EEE 362: Signal and Systems

1 Course Time Table				
Course number and Title: **EEE 362** **Signals and Systems II**	Name of Instructor: **Engr. Dr. David Ebregbe**	Class B.Eng Electrical and Electronic Engineering	Semester Second semester	Duration April 2023- July 2023
Credit hours: 3	(Theory)	**Class Timings:** Tuesdays 2pm - 4pm Thursday 2pm - 4pm		

2 Course Description/Objectives

The objective of this course is to develop the understanding of the basic ideas of the Signals & Systems encountered in engineering. The main focus will be on the methods for characterizing and analyzing continuous-time and discrete time signals and systems. Students will

learn some transform techniques (Laplace transform, Z-transform and Fourier transform) that are useful for the understanding of Digital communication systems, Feedback control systems, Satellite and mobile communications, Digital signal processing and Digital image processing.

Objectives

- To describe various signals and systems mathematically and understand how to perform mathematical operations on them.
- Also familiar with commonly used signals such as the unit step, ramp, and impulse function, sinusoidal signals, complex exponentials and their operations.
- Analysis using Fourier series and Fourier transform for a given signal.

3 Course Outlines

Course Outline:
System Representations • Differential Equations • Laplace Transfer function • Convolution Sum/Integral • block diagram • state space representation
Realization Theory and Calculation of transfer functions

System properties

- Linearity
- Invariance
- Causality
- Stability

Frequency Response Theory

- Signal and System analysis in frequency domain
- Fourier Series and Fourier Transform,
- Sampling theorem,

Discrete Fourier transform (DFT),

- estimating Fourier transform using DFT. MATLAB
- Fast Fourier Transform (FFT)

Testbooks and other Reading Materials

1) Introduction to Signals and Systems, Douglas K. Lindner

4 Course Learning Outcomes (CLO's)

S/N	CLO	Domain	Taxonomy level	PEO	Assessment
1	Identify and report system properties such as causality, stability, linearity, and time invariance	Cognitive	2	2	Quizzes + Final Exams

	etc.				
2	Apply the convolution sum/convolution integral formulas to determine the output of continuous time/discrete time systems.	Cognitive	3	1	Assignment + Final Exam
3	Analyze continuous and discrete time signals and systems in the time and frequency-domain using Fourier, Laplace and z-transforms.	Cognitive	4	4	Assignment + Final Exam
4	Develop input output relationship for linear shift invariant system and understand	Cognitive	5	3	Assignment + Final Exam

	the convolution operator for continuous and discrete time system.				
5	Preparation for further study.	Cognitive	3	2	Term Paper
6	Problem solving aspects.	Cognitive	5	3	Quizzes + Assignment + Final Exam

5 Detailed Lecture Plan

Week No.	Lecture	Course Contents to be Covered	Required reading
		System Representations. • Differential Equations • The Transfer function • Convolution Integral/Sum • Block diagrams - Interconnection of Systems - Block Diagram Reduction	Douglas Lindner – Chapter 10

1-4	1-8	- All Integrator Block Diagrams • State Space Equations - All Integrator Block Diagrams from State Space Equations • Relationship between system Representations	
5 – 8	9 - 16	**Realization Theory** • Calculation of Transfer Functions from State Space Representation • State Space Representation to Transfer Function • First Realization • Second realization • State Equations from Physical Laws • Incorporation of Initial Conditions into State Space Equations - Observability Matrix	Douglas Lindner – Chapter 11
9-11	17-22	**System properties** • Linearity • Invariance • Causality • Stability	Prepared Lecture Materials

12-13	18 - 21	**Frequency Response Theory** • Signal and System analysis in frequency domain • Fourier Series and Fourier Transform, • Sampling theorem,	Prepared Lecture Materials
14 - 15	22 - 25	**Discrete Fourier transform (DFT),** • estimating Fourier transform using DFT. MATLAB • Fast Fourier Transform (FFT)	Prepared Lecture Materials

6. Second Semester (2023 -2024 Session)		
Commencement of Classes	11^{th} Dec 2023	
Classes End	2^{nd} March. 2024	
Exams Begin	4^{th} March. 2024	
Exams End	30^{th} March. 2024	
7. Evaluation Criteria		
Component of Assessment	**Method**	**Marks**
During Semester	Assignments	10

	Written Test Attendance	10 10
Examination	End of Semester Exam	70
Total		100

EEE 372: Electrical Machines II

Course Time table				
Course Title/Code: **Electrical Machines II (EEE 372)**	**Name of Lecturers:** **Engr. John Tarilayon Afa**	**Class Level:** **300 Level**	**Semester:** **Second Semester**	**Duration:** **April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 4pm – 6pm** **Thursday 4pm – 6pm**		

Course Description/Objectives

This course aims to develop advanced understanding electric motors and speed control of electrical machines. In particular, the analytical models of DC and AC machines are manipulated to achieve speed control of these machines.

Course Outlines

3. Machines: Induction AC and DC
4. Production of rotating magnetic fields, important characteristics of DC Synchronous, and induction motors .
5. Rotor wound and squirrel cage motors.
6. Constructional features of synchronous machines.
7. Torque/speed characteristics, speed control.
8. Starting Induction regulators.
9. Fractional Horsepower motors. V. curves, power factor control.
10. Principles of Electrical machines design.
11. The output equation, calculation of machine parameters, Saturation problems in machine design.
12. Specific electric and magnetic loading related to cooling of machines.
13. Definition and classification of windings: Coil construction and insulation; physical problems connected with single and double layer winding; Specific design problems.

Recommended textbooks

1) Elect~Ical Machines, Drives, And Povver Systems Fifth Edition by THEODORE WILDI
2) Principle of Electrical Machines and power electronic by P. C. Sen

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Explain operating principles of fundamental components of Electric Machines: motors, including synchronous, asynchronous, DC and special purpose motors,	Cognitive	2	2	
2	Examine the magnetic field, reluctance of magnetic materials, flux and emf in magnetic circuits	Cognitive	2	1	
3	Examine construction, working principles, and equivalent circuit of	Cognitive	5	2	Classwork + Assignment + Attendance

	synchronous motors and induction motors				
4	Analyse the torque speed characteristics and speed regulation of DC motors.	Cognitive	4	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Introduction of AC and DC Induction	Electrical Machines, Drives, And Power Systems Fifth Edition by THEODORE WILDI 2.Principle of Electrical
2	2	Production of rotating magnetic fields, important characteristics of DC Synchronous, and induction motors .	
3	3	Rotor wound and squirrel cage motors.	
4	4	Torque/speed characteristics, speed control.	

5	5-6	Principles of Electrical machines design.	Machines and power electronic by P. C. Sen.
6	7	The output equation, calculation of machine parameters, Saturation problems in machine design.	
7 – 9	8 – 11	Definition and classification of windings: Coil construction and insulation; physical problems connected with single and double layer winding; Specific design problems.	
10 – 11	12 – 15	Constructional features of synchronous machines.	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE-333: Object-Oriented Software Engineering

Course Time table				
Course Title/Code: **Object-Oriented**	**Name of Lecturers:**	**Class Level:**	**Semester:** **First**	**Duration:** **November,**

Software Engineering (EEE 333)	**Tony Miebi**	**300 Level**	**Semester**	**2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Mondays, 4.00 pm – 6.00 pm** **Thursdays, 12.00 pm –2.00 pm**		

Course Description/Objectives
The course is intended to introduce the students to the art of providing computing solutions to problems through the writing of object-oriented programs, with Java as the language of choice. The course will introduce the concept of classes and objects, and how they shape the way object-oriented programs are written. The course will re-examine the core programming concepts of procedural programs, branching/selection, and iterating/looping, arrays, and strings through Java. Moving beyond the core concepts, the course will cover array lists, text file processing, user-defined methods and classes.
Course Outlines
14. Introduction to object-oriented programming 15. Identifiers in Java 16. Basic java application template 17. Types of data 18. Comments in Java 19. Writing data to screen 20. Basic data storage 21. Reading data from keyboard 22. Arithmetic operators 23. Math constants and methods 24. Boolean operators

25. Branching/selection
26. Increment and decrement operators
27. Looping/iterating
28. Arrays
29. Array lists
30. Strings
31. Managing exceptions
32. Processing text files
33. User-defined methods
34. User-defined classes

Recommended textbooks

3) Java for Everyone – Late Objects by Cay Horstman
4) Introduction to Java Programming & Data Structure by Y. Daniel Liang
5) Java - How to Program by P. Deitel and H. Deitel
6) Sarma, Thomas J. Overbye. Global Engineering. USA.

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand the concept of object-oriented programming, and how it affects access to predefined programming tools.	Cognitive	1	1	Classwork + Assignment + Attendance

2	Understand the concept of identifiers, data, variables, operators, math functions/methods, branching, looping, arrays as presented through Java.	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Understand what an array list is, and how it is used in providing programming solutions.	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Understand exceptions, their handling, and they are used in processing files in Java.	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Understand how to write user-defined methods, classes, and how they are used to write object-oriented programs in Java.	Cognitive	5	3	Classwork + Assignment + Attendance

Week	Lecture	Course Content to be Covered	References

No			
1	1 – 2	Introduction to object-oriented programming. Identifiers in Java. Basic java application template	1. Java for Everyone – Late Objects by Cay Horstman 2. Introduction to Java Programming & Data Structure by Y. Daniel Liang 3. Java - How to Program by P. Deitel and H. Deitel
2	3 – 4	Types of data: data size, range, rules for writing liberals. Comments in Java: Single and multiline comments, Java documentation comments. Writing data to screen: Using method from class System, and JOptionPane	
3	5 – 6	Basic data storage, Reading data from keyboard: methods from Scanner, methods from JOptionPane and Wrappers. Arithmetic operators: unary, and binary operators, operator precedence. Math constants and functions.	
4	7 – 8	Boolean operators: equality operators, relational operators, logical operators, short-circuit evaluation. Branching/selection: ternary operator, as well as, if, if-else, nested if-else, and switch statements	
5	9 – 10	Increment and decrement operators: Pre/post increment and decrement. Looping/iterating:	

		while, do-while, and for-loops, nested loops	
6	11 – 12	Arrays: single and multi-dimensional arrays, ragged arrays.	
7	13 – 14	Array lists, Strings: string processing methods, string tokens and tokenization.	
8	15 – 16	Managing exceptions. File processing: Writing to text files with methods from PrintWriter. Reading from text files with methods from Scanner	
9 – 10	17 – 20	User defined methods	
11 – 12	21 – 24	User defined classes	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 380 Principle of Power Engineering

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**

Principle of Power Engineering(EEE 380)	**Engr. Dr. Priye Kenneth Ainah**	**300 Level**	**Second Semester**	**April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Tuesday 10 am – 12pm** **Thursdays, 4 pm – 6pm**		

Course Description/Objectives

The course is focus on magnetic field, fundamental of electromechanical energy conversion, rotating machines and transformer. The course also discusses DC machines and its characteristics.

Course Outlines

1. Evolution of electric power industry. History and evolution of Nigerian Electric power industry.
2. Major power generation sources; hydro-electric, Nuclear, thermal, (gas and coal) wind, solar etc.
3. Economics of systems design, choice of site for power plants, choice of system voltage, system loses and efficiency.
4. Power plant auxiliaries; consideration of design, essential and non-essential auxiliaries
5. Distribution of load between sources.
6. Effect of transmission loses. Power system equipment.
7. Distribution generation, Feed-in tariff scheme, Micro-grid scheme.

Recommended Texts

1. Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York
2. Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering. USA.

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand the evolution of the electricity industry in Nigeria.	Cognitive	1	1	Classwork + Assignment + Attendance
2	Identify the major power generation sources such as hydro plant, thermal and nuclear plant, wind, and solar	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Calculation of the transmission line parameters	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Design consideration	Cognitive	5	3	Classwork + Assignment

	of power auxiliaries				+ Test + Attendance
5	Explain distribution generation, feedin tarrif and micro-grid scheme	Cognitive			

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Evolution of the electricity industry in Nigeria.	1. Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York 2. Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global
3 – 5	5 - 6	Explanation of major power sources such as hydro, thermal, Nuclear, etc.	
6 - 7	7-8	Economics of system design, choice of site for power plant	
8 – 9	9-10	Power plant auxillaries and design consideration	
10	11	Effect of transmission loseses	
11 – 12	12	Distribution generation, feedin tarrif and micro-grid	

			Engineering. USA.
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

400 LEVEL COURSES

EEE 415: FIELD THEORY II

Course Time table				
Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Field Theory II/EEE 415	Engr. Godday Biowei	400 Level	First Semester	November, 2022 – March, 2023
Credit Unit: 4	Credit hours: 4	Class Timing: Mondays 8 am – 10 am Thursdays 8 am – 10 am		

Course Description/Objectives

The primary goal of field theory II is to explain electromagnetism, which is the fundamental force of nature. There are very few devices that operate without utilising any electromagnetic theory of effect. Transmission of power, electricity generation, actuator, radio, television and microwave transmission and reception are all made possible by electromagnetism. For electromagnetic designs, a solid theoretical grasp of the electromagnetic field equations is needed, knowledge of the displacement currents described by Maxwell's equations, which are responsible for wave propagation, to characterise the characteristics of electromagnetic waves and to comprehend their nature and the reasons for their existence.

Course Outlines

1. Development of Maxwell's equations and general electro-magnetic theory underpinning communication transmission and device applications.
2. Plan waves in lossy media, propagation in unbounded and bounded media, guided wave propagation in common waveguide geometries, radiation, and antennas.
3. Review of Maxwell's equations, TEM modes in a linear homogenous isotropic medium, polarization, Pointing vector and power flow, TEM waves incident on a boundary - Snell's laws, wave propagation inside a conductor - skin depth, weakly dispersive TEM modes - phase and group velocity.
4. Field analysis of guided TEM modes (transmission lines), characteristic impedance, voltage and current relationships, impedance discontinuities and standing waves, impedance matching, Smith chart, pulse propagation in transmission lines, lossy lines.

Recommended textbooks

1. “Engineering Electromagnetics” by Nathan Ida, Published by Springer-Verlag New York, Inc. in 2000
2. “Computational Electromagnetics for RF and Microwave Engineering” Cambridge University Press 2005.
3. “Applied Electromagnetics and Electromagnetic Compatibility” by D. Sengupta and V. Liepa. Wiley 2006

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand the fundamental concepts of electromagnetism	Cognitive	2	1	Classwork + Assignment + Test + Attendance
2	Have good knowledge of Maxwell’s equations and use to solve electromagnetic field problems	Cognitive	3	2	Classwork + Assignment + Test + Attendance
3	Analysis of electromagnetic field wave guides	Cognitive	4	3	Classwork + Assignment + Test + Attendance
4	Show skills of engineering	Cognitiv	5	2	Classwork +

	electromagnetic in wireless communications	e			Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Write Maxwell's equations in point and integral forms. Convert from point form to integral form	6. "Engineering Electromagnetics " by Nathan Ida, Published by Springer-Verlag New York, Inc. in 2000 7. "Computational Electromagnetics for RF and Microwave Engineering" Cambridge University Press 2005. 8. "Applied Electromagnetics and Electromagnetic Compatibility" by D. Sengupta and V. Liepa. Wiley 2006
2 – 3	3 - 4	Obtain expression for α and β, deduce intrinsic and skin depth of a wave	
4 – 5	5 – 7	Use of auxiliary function to determine the filed produced by a given source distribution	
6 – 8	8 – 10	Understanding wave behaviour between two media	
9 – 11	11 – 12	Wave guides and modal propagation properties	
12 – 14	13 – 15	Transmission lines	
15	16 – 17	Revision	
16	**Final Semester Examination**		

EEE 431: Introduction to Microprocessors

Introduction to Microprocessors

Course Time table				
Course Title/Code: Introduction to Microprocessors /EEE 431	Name of Lecturers: Engr. Jenny E. Fawei	Class Level: 400 Level	Semester: First Semester	Duration: November, 2022 – March, 2023
Credit Unit: 3	Credit hours: 8	Class Timing: Wednesdays 2pm – 6pm		

Course Description:

This course introduces microprocessor architecture and microcomputer systems, including memory and input/output interfacing. Topics include Microprocessor architecture, types of Microprocessor and their applications, assembly language programming, bus architecture, I/O systems, memory systems, interrupts, and other related topics. Upon completion, students should be able to interpret, analyze, verify, and troubleshoot fundamental microprocessor circuits and programs using appropriate techniques and test equipment. Course Hours Per Week: Class, 3. Lab, 3. Semester Hours Credit, 3.

Course Outline

- Definition and history of Microprocessor
- Microprocessor structure and types
- Microprocessor vs Microcontroller
- Examples of Microcontrollers
- Microcontroller Applications

- Microcontroller Classification
- Microprogramming and Assembly language instructions
- Architecture & Support Components Interfacing to the Real World

Recommended Textbook

1. Fundamentals of Microprocessor and Microcontrollers by B. Ram, Dhanpat Rai Publication, Bangalore.
2. "Microcomputer Systems: The 8085/8086 Family architecture, Programming, And Design", Second Edition by Yu-Cheng LIU & Gienn A. GIBSON
3. "Fundamentals of Microprocessor and Microcontrollers", by B. Ram, Dhanpat Rai Publication, Bangalore.
4. Programming Arduino: Getting Started with Sketches (second edition) by Simon Monk.

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Learn the fundamental concepts of microprocessors	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have good knowledge of microprocessor structures and I/O devices	Cognitive	2	2	Classwork + Assignment + Test + Attendance

3	Learn the differences between microprocessors and microcontroller systems	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Learn basic Microprogramming and Assembly language instructions	Psychomotor	5	3	Classwork + Assignment + Test + Attendance
5	Hands-on exercise on microcontroller systems	Psychomotor	5	3	Classwork + Assignment + Attendance

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Definition of microprocessor, component and history of microprocessor, Types of microprocessors	9. "Fundamentals of Microprocessor and

2 – 3	3 - 4	Microprocessor vs microcontrollers: structures, I/O devices, applications, examples of microcontroller system	Microcontrollers", by B. Ram, Dhanpat Rai Publication, Bangalore. 10. "Microcomputer Systems: The 8085/8086 Family architecture, Programming, And Design", Second Edition by Yu-Cheng LIU & Glenn A. GIBSON 11. "Fundamentals of Microprocessor and Microcontrollers", by B. Ram, Dhanpat Rai Publication, Bangalore. 12. Programming Arduino: Getting Started with Sketches
4 – 5	5 – 7	Understanding the Basic Architecture of the 8-Bit Microcomputer the Intel 8085/86; Instruction set and addressing scheme	
6 – 8	8 – 10	Microprogramming and Assembly language instructions.	
9 – 10	11 – 12	Interfacing to the real-world and embedded system design with Microcontrollers	
11-12	13-14	Building and programming circuit with microcontroller (hands- on).	
13–14	15 – 16	Revision	
15	15 – 16	Test	

			(second edition) by Simon Monk.
16	**Final Semester Examination**		

EEE 485: High Voltage Engineering I

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
High Voltage Engineering I (EEE 485)	**Engr. John Tarilayon Afa**	**400 Level**	**First Semester**	**November, 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 12pm – 2am** **Thursday 12pm – 2pm**		

Course Description/Objectives

The course is focused on the analyses, generation, measurement and, the measuring methods of high voltage and current in power system. The different fundamental processes of electrical discharges will be discussed. Also, different electrode configurations, and calculation using electric field will be analyzed. The impact of high voltage on technical losses will be discussed. The objectives of the course are to analyze the generation of high voltage and current, describe the measurement of high voltage and current, list the fundamental processes of electrical discharges, have a fair knowledge in the testing of high voltage equipment, analyze losses that are associated with high voltage currents and have a fair knowledge in travelling waves in transmission lines

Course Outlines

3. Generation of high AC, DC and impulse voltages.
4. High voltage measuring methods and devices, Voltage transients and line surges in power systems.
5. Fundamental processes of electrical discharges.
6. Electric field calculations for different electrode configurations.
7. Generation and measurement of high currents.
8. Technical losses in power networks due to high currents.
9. Traveling waves in transmission lines,
10. protection of over-headlines.

Recommended textbooks

1) High Voltage Engineering, fundamental by E. Kuffel, W.S. Zaengl and J. Kuffel
2) Advances in High Voltage Engineering by IET Power and Energy Series 40
3) High Voltage Engineering: Theory and Practice second Edition by Mazen Abdel Salam, Hussein Anis, Ahdab El-moshedy and Rashdy Radwan

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Describe the principle of generating high DC-AC and impulse voltage	Cognitive	2	2	
2	analysis and perform dynamic response of high voltage measurement systems	Cognitive	2	1	
3	Describe and compute the breakdown strength of gas, liquids and solids insulation systems	Cognitive	5	2	Classwork + Assignment + Attendance
4	Develop equivalent circuit models of the	Cognitive	4	3	Classwork + Assignment + Test + Attendance

	different high voltage generators				
5	Determine the transient voltages and their propagation characteristics	Cognitive	4	3	Classwork + Assignment + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Generation of high AC, DC and impulse voltages	1)High Voltage Engineering, fundamental by E. Kuffel, W.S. Zaengl and J. Kuffel 2)Advances in High Voltage Engineering by IET Power and Energy Series 40 3)High Voltage
2	2	High voltage measuring methods and devices, Voltage transients and line surges in power systems	
3	3	Fundamental processes of electrical discharges	
4	4	Electric field calculations for different electrode configurations	
5	5-6	Generation and measurement of high currents.	

6	7	Technical losses in power networks due to high currents	Engineering: Theory and Practice second Edition by Mazen Abdel Salam, Hussein Anis, Ahdab El-moshedy and Rashdy Radwan.
7 – 9	8 – 11	Traveling waves in transmission lines	
10 – 11	12 – 15	protection of over-headlines	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 487: Power System Analysis

Course Time table				
Course Title/Code: **Power System Analysis (EEE 487)**	**Name of Lecturers:** **Engr. Dr. Priye Kenneth Ainah**	**Class Level:** **400 Level**	**Semester:** **First Semester**	**Duration:** **November, 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 8am – 10am** **Friday 4pm – 6pm**		

Course Description/Objectives

The objective of the course is to teach student concept of power system engineering. The course describes the operation of the interconnected power system under steady and dynamic conditions. It is also an important part of power system design, and calculation to verify the electrical power system components. It also describes unsymmetrical faults using symmetrical components and load flow studies.

Course Outlines

1. Power systems representation and complex power
2. Sinusoidal steady state concept
3. Per unit systems representation
4. Load flow analysis
5. Three phase symmetrical components theory and unbalanced faults analysis
6. Steady state and transient stability
7. The swing equation and area criterion

Recommended textbooks

1 Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York

2 Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering. USA.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Understand the basic	Cognitive	2	2	

	principle of power in single phase AC circuit and the complex power balance.				
2	Identify single line representation of a power system network.	Cognitive	2	1	
3	Determine the per unit value of generator, transformer, motors, transmission line, parallel and series load.	Cognitive	5	2	Classwork + Assignment + Attendance
4	Analyse different load flow concept such as Guess-Seidel technique, newton raphson techniques, fast decouple technique etc.	Cognitive	4	3	Classwork + Assignment + Test + Attendance

5	Analyse the three phase symmetrical components theory and unsymmetrical faults.	Cognitive	4	3	Classwork + Assignment + Attendance
6	Solve simple problems on line to ground faults, double line to ground faults, etc.	Cognitive	5	3	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Basic concept of single-phase AC circuit and complex power ✓ Understand the power concept encountered in electrical circuit theory ✓ Understand the energy flow in an AC circuit. ✓ Understand the transmission of complex power between two voltage sources ✓ Understand power system representation	1) Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global

			Engineering. USA. (2) Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York .
2	2	The study of Per unit systems representation for transmission line, generator, motors and load ✓ Understand the importance of per unit system in power system analysis ✓ Analyse the per unit system for a generator, motors, transformers, transmission lines, parallel and series loads ✓ Solve question on per unit conversion.	
3	3	Load flow analysis (Guess-Seidel) ✓ Understand the power flow program concept ✓ Understand the iteration solution to linear algebraic equation (Gauss-Seidel and Jacobi). ✓ Analyse the iterative solutions to nonlinear algebraic equations: newton–raphson ✓ Solve power flow problems using Gauss-Seidel power flow technique	

4	4	Three phase symmetrical components theory	
5	5-6	Unsymmetrical faults (unbalanced faults analysis such as LG, LLG, LLLG ✓ Analyse and identify unbalance fault (unsymmetrical faults such as LG, LLG. L-L, and LLLG) ✓ Solve problem involving unsymmetrical fault using the symmetrical component concept.	
6	7	Symmetrical fault Analysis (LLL fault)	
7 – 9	8 – 11	Introduction to Steady state and transient stability ✓ To understand the nature power system stability issues ✓ Understand the behaviour of synchronous machine after a disturbance ✓ To understand the significance of the power angle ✓ To understand the behaviour of the system under small disturbance (steady state stability).	

10 – 11	12 – 15	Intoduction of swing equation and area criterion	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 489: Renewable Energy Systems: (3 Units)

COURSE TIME TABLE				
Course Title/Code: Renewable Energy Systems /EEE 489	Name of Lecturers: Tebe Larry Ojukonsin	Class Level: 400 Level	Semester: First Semester	Duration: September – December
Credit Unit: 3	Credit hours: 6	Class Timing: Tuesday days 12noon – 2pm and Thursday : 2pm to 4pm and Practical on Wednesdays		

Course Description/Objectives
This course covers the various aspects of renewable energy system, their advantage over non-renewable energy system due to non or no carbon footprint. To enable the understanding of renewable energy technology

in the broadest terms. Present different technologies option for harvesting and using renewable energy. Shows the strength and weakness of renewable energy. And to review the issues affecting the effective deployment of renewable energy systems.

Course Outlines

1. Introduction to renewable energy systems:
2. Basic principles underpinning sustainable energy technologies: Wind power, Tidal, Marine, and Hydro power, Photo-Voltaic systems, Biomass, Biofuels, Fuel Cells, e.t.c.
3. Discuss intermittence of renewable energy sources; storage systems; Batteries, knowing the various technology underpinning battery designs and their deployment in renewable energy system, battery sizing and load management.
4. Distribution Generators: Connection issues for distributed generation, Connection issues for offshore wind energy. Planning for reserve and response services

Recommended Textbook

1. Renewable Energy Technologies- R. Ramesh, Narosa Publication
2. Renewable energy sources and Emerging Technologies, D.P. Kothari, PHI
3. A future Micro-grid Implementation based on renewable Distributed Resources for clean Green Energy Production " F Marin, A Rey and F. Ruz (1 April 2006) Environmental Science, Engineering, Renewable Energy & Power Quality Journal

The full report 'Bioenergy – a Sustainable and Reliable Energy Source' is available on the IEA Bioenergy website (www.ieabioenergy.com)

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Discuss and classify energy sources into renewable and non renewable and their environmental impact. Student are able to determine how to plan for reserve and response services when using renewable sources.	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have good knowledge of the various ways to annex solar radiation and wind speed	Cognitive	2	2	Classwork + Assignment + Attendance
3	Learn the various parts to develop a solar power system	Cognitive	3	2	Classwork + Assignment + Attendance
4	Be able to differentiate offshore wind	Psychomotor	5	3	Classwork + Assignment

	and on-shore wind and the impact on marine lives and birds. Understand wind energy design features; cut-in wind and cut-off wind.				+ Attendance
5	Be able to size storage system and renewable energy sources generators	Psychomotor	5	3	Classwork + Assignment + Attendance
6	Learn how to carry out feasibility study of a site that wants to annex the use of renewable energy generation.	Psychomotor	5	3	Coursework + attendance
7	Be able to calculate load and estimate the most suitable combination of renewable energy generation that	Psychomotor	5	3	Classwork + attendance

	will match the loads.				
8	Be able to analyse Hydropower Yield and understand their application for providing base load ; Acknowledge the concept of pump storage of excess renewable energy from other sources such as wind and solar	Psychomotor	5	3	Coursework + attendance
	Discuss and gained knowledge on distributed generation, feed-in tariff plan,.	Cognitive	1	2	Classwork + Attendance

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1-2	Discuss Renewable and non-renewable energy source and their environmental impact. Energy Efficiency and Energy security.	1. Renewable Energy Technologies- R. Ramesh, Narosa Publication 2. Renewable energy sources and Emerging Technologies, D.P. Kothari, PHI 3. A future Micro-grid Implementation based on renewable Distributed Resources for clean Green Energy Production " F Marin, A Rey and F. Ruz (1 April 2006) Environmental Science, Engineering, Renewable Energy & Power Quality Journal 4. The full report 'Bioenergy – a Sustainable and Reliable Energy Source' is available on the IEA Bioenergy website
2	2 - 4	Solar Energy: Solar Thermal systems: Type of solar collectors. Efficiency calculations and application	
3	5 – 6	Photovoltaic (PV) technology: Present status, Solar Cells ,cell technologies, PV characteristics, equivalent circuit, array design, building integrated PV system, installation components, sizing and economics. Standalone and grid connected systems.	
4-5	7 – 11	Wind Energy: Wind Speed and Power relation. Power extraction from wind; wind Power generator	

		system components; Types of turbines/turbine ratings. Variable speed operation, control system, other system design features. Offshore and on shore wind power. Grid connected and standalone systems	(www.ieabioenergy.com)
6– 7	12 – 14	Hydro power Generation: Dams and Run-off Water, Marine and Tidal systems. Design consideration and Calculation of the power generated. Pump storage	
8	15-16	Biomass, Biofuel: First, Second and Third Generation Biofuel.	
9	17-18	Energy Storage: Battery types, performance characteristics, charging and discharge regulators. Battery Management. Fuel cell energy storage system, Flywheel relations, components, benefits over battery. Pumped Storage for Hybrid with	

		Hydro power plants.	
10	19-20	Distribution Generation. Microgrid Concept and its components, Interface requirements for interconnectivity of various systems. Load Scheduling, Feed in Tarriff and reserve and response services	
11-12	21 – 22	Group Seminar Series of each Sources of Renewable Energy.	
13	23-24	Revision	
15	Final Semester Examination		

EEE 483 Power Electronics

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
Power Electronics (EEE 483)	**Engr Godday Biowei**	**400 Level**	**First Semester**	**November 2022 – March, 2023**
Credit Unit:	**Credit**	**Class Timing: Mondays 8 am –**		

3	**hours: 4**	**10am** **Wednesdays, 12.00 pm – 2.00 pm**

Course Description/Objectives
The course is focus on application of semiconductor on power control, switching, power diode, transistors, thyristors, GTO and their characteristics. It also discussed DC-DC converters and AC/DC inverter and different topologies. Also, harmonics and power quality are discussed.
Course Outlines
1. Application of power semiconductor components and devices to power system problems; 2 Power control; conditioning processing, and switching. **3.** Power electronic devices: Power diodes, power transistors, thyristors, voltage and current regulators. GTO, their characteristics, ratings, protection and cooling; **4.** Power circuit topologies: Series parallel operation of devices; Firing and typical control circuits. **5.** Power electronic converters: Phase controlled (AC/DC), 1-phase/3 semi/full; **6.** Analysis and performance with passive load, typical control circuit; **7.** Harmonics and power factor; Voltage controllers (AC/DC), 1-phase/3-phase; Typical control circuits for integral control/phase control strategies. **8.** DC/AC inverters: 1-phase/3-phase; VSI, PWM, CSI, frequency and voltage control; Harmonics and power quality, typical control circuits; High frequency inverters. **Recommended Texts** 1 Power Electronics Design Handbook Low-Power

Components and Applications
2 By Nihal Kularatna
3 Power Electronic: Converters, Application and Design by Ned Mohan, Tore M. Undeland, Willian P. Robbins
4 Principle of Electrical Machines and power electronic by P. C. Sen

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	understand the principles of power control by switching; demonstrate the benefits of switched mode circuits; be familiarised with the commonly used semi-conductor switching devices;	Cognitive	1	1	Classwork + Assignment + Attendance
2	demonstrate a full understanding on several DC-DC converters; perform analysis on	Cognitive	2	2	Classwork + Assignment + Test + Attendance

	their operation principles; develop design equations for selecting their components;				
3	comprehend the operation principles for several thyristors-based rectifiers; quantify the current harmonics and the average power drawn by a rectifier;	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	understand the H-bridge based inverters and their several control methods	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Analyze the different modes of operations for the inverters; gain the understanding	Cognitive	5	3	Classwork + Assignment + Attendance

	on how the power is delivered or absorbed by grid-connected inverters				

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Overview of semiconductor and their application of power semiconductor components	1. Power Electronics Design Handbook Low-Power Components and Applications 2. By Nihal Kularatna 3. Power Electronic: Converters, Application and Design by Ned Mohan, Tore M.
3 – 5	5 - 6	Power control; conditioning processing, and switching	
6 - 7	7-8	Power diodes, power transistors, thyristors, voltage and current regulators. GTO, and their characteristics,	
8 – 9	9-10	Power electronic converters: Phase controlled (AC/DC), 1-phase/3 semi/full	
10	11	Harmonics and power factor; Voltage controllers (AC/DC), 1-phase/3-phase; Typical control circuits for integral control/phase control	

		strategies.	Undeland, Willian P. Robbins
11 – 12	12	DC/AC inverters: 1-phase/3-phase; VSI, PWM, CSI, frequency and voltage control; Harmonics and power quality, typical control circuits; High frequency inverters	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 441: Control Engineering 1

COURSE TIME TABLE				
Course Title/Code: Control Engineering 1 /EEE 441	Name of Lecturers: Engr. Dr Diton Geku	Class Level: 400 Level	Semester: First Semester	Duration: November 2022– March 2023
Credit Unit: 3	Credit hours: 4	Class Timing: Tuesdays 10am-1pm		

Course Description/Objectives

This course covers basic principles of modelling, simulation, analysis and design of classical Single-Input-Single-Output (SISO) control systems by deploying Ordinary differential equation in the time domain to laplace transform representation in the frequency domain in order for students to find modelling approachable and easy to analyse. The notion of PID and Lead-lag controller design and application for industrial operations was also covered. Further more the concept of error reduction, stability and time response analysis of the output response was also demonstrated in theory and simulation for students to be able to adapt their design to a desirable output.

Course Outlines

- Introduction to classical and Modern control; Laplace transform and partial fraction review.
- Basic concept of Open Loop and closed loop systems; and Notion of Feeb-back
- Signal flow graphs; State Space Characterization and time-domain analysis
- Modelling and representations of Electrical, Mechanical and Process control Systems: Ordinary differential equations; Transfer functions; Block diagrams representation and state space representation.
- Performance and stability: Time-domain analysis; first order and second order systems; characteristic equations and roots; Routh-Hurwitz criteria.
- Frequency Domain Techniques: Root-Locus Methods; Frequency response analysis; Bode Plots, Gain Margin and Phase Margin; Nyquist plots and using the plots to determine stable, critically stable and unstable system.
- Compensator Design: Proportional P, Proportional-Integral PI

and Proportional-Integral-Differential PID Controllers; Lead-Lag Compensators and their effect on system transfer function and stability.

Recommended Textbook

5. Automatic Control Systems (With Matlab Programmes) by S. Hasan Saeed (2008)
6. Control System Engineering (6th Edition) by Norman S. Nise (2011)
7. Modern Control Engineering, Katsuhiko Ogata, Pearson Education Inc.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Discuss the various aspects Control System Engineering applications	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have good knowledge of open loop and closed loop systems determination and their areas of applications	Cognitive	2	2	Classwork + Assignment + Attendance
	Learn mathematical	psychomot	1	1	Classwork +

	tools that will help in modelling and function blocks; ordinary differential equation, partial fraction and laplace transform	or			Attendance
3	Learn how to model electrical, mechanical and process systems	Psychomotor	2	2	Classwork + Assignment + Attendance
4	Reduce complex inter-dependent models into blocks and carry out block diagram reduction	Psychomotor	2	3	Classwork + Assignment + Attendance
5	System response analysis Error, Error reduction and stability	Psychomotor	5	3	Classwork + Assignment + Attendance

6	Learn about First Order and Second order systems, Time response analysis and characteristic equation	Psychomotor	5	3	Coursework + Assignment + attendance
7	PID Controllers design, Disturbance isolation and Lead-Lag compensators to obtain desired response of a closed loop system	Psychomotor	2	2	Coursework + Assignment + attendance
8.	Matlab Simulation to gain indebt understanding of controller design action to eliminate steady state error, reduce stability and carry out frequency response analysis using bode plot and	Cognitive	5	3	Coursework + Group Work

	Nyquist chart.				

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1	Introduction to control Systems: applications, basic features of a control systems, control systems design objective and design process, and the benefits of studying control systems.	Automatic Control Systems (With Matlab Programmes) by S. Hasan Saeed (2008)
1-2	2 – 3	Laplace transforms, Partial Fraction and block diagram representation	1.Automatic Control Systems (With Matlab Programmes) by S. Hasan Saeed (2008) 2.Control System Engineering (6th Edition) by Norman S. Nise (2011) 3.Modern Control Engineering, Katsuhiko Ogata, Pearson Education Inc.
3	4-5	Block Diagram reduction,	
4-5	6 – 9	Mathematical Modelling of Systems in time and frequency domain and transfer functions formulation	
6	10-11	First Order and Second order systems: Systems response to a step and ramp input	
7	12-13	Time Response Characterization, disturbance and Error reduction (with Matlab simulations)	
8	14-15	Introduction to Stability, Routh Hurwitz characterization	

9-10	16-19	Frequency response Analysis: Nyquist Stability Criterion, Bode Plots and Stability Margins in frequency domain (using Matlab)	
11	20 – 21	Basic controller design, the proportional, integral and derivative (PID) actions	
12	22-23	Application of PID controllers and compensators to obtain desired system response	
13	24-25	Introduction to State Space methods, linearization of nonlinear systems	
14	26-27	Test and Matlab simulations	
15	28	Revision	
16	Final Semester Examination		

EEE-439 Web Technologies

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
Web Technologies (EEE 439)	**Tony Miebi**	**500**	**First Semester**	**November, 2022 – March,**

		Level		**2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 2pm – 4pm** **Wednesday 12pm – 2 pm**		

Course Description/Objectives
The focus in this course is on the World Wide Web as a platform for interactive applications, content publishing and social services. The development of web-based applications requires knowledge about the underlying technology and the formats and standards the web is based upon.
Course Outlines
5 Principles of Web programming with emphasis on AJAX. **6** Relationships between HTML, DOM, JavaScript for client-side computation **7** PHP, Java and Ruby using a relational database for server-side computation. **8** Design, implementation, and test of a large Web application. **9** XHTML Style Sheets PHP, JavaScript, JavaScript and XHTML Documents **10** Dynamic Documents in JavaScript, Flash, XML, AJAX. **11** Java Web Software, Ruby on Rails. **Recommended textbooks** 1 Web technology by M. V. Zelkowitz. Academic press, 2006 2 Discovering Web Access Patterns and Trends by applying Olap and data mining technology on web logs by Zaiane O.R., Xin M. Han J.

3	Web Design for Teens by Maneesh Sethi. Course Technology PTR

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Describe what IoT is and how it works today	Cognitive	3	1	Classwork + Attendance
2	Recognize the factors that contributed to the emergence of IoT	Cognitive	2	2	Classwork + Assignment + Attendance
3	Design and program IoT devices	Cognitive	5	2	Classwork + Assignment + Attendance
4	Use real IoT protocols for communication	Cognitive	3	1	Classwork + Assignment + Test + Attendance
5	Secure the elements of an IoT device.	Cognitive	4	3	

6	Design an IoT device to work with a Cloud Computing infrastructure.	Cognitive	5	3	
7	Transfer IoT data to the cloud and in between cloud providers	2	2		
8	Define the infrastructure for supporting IoT deployments	2	2		

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1 -2	Principles of Web programming with emphasis on AJAX	1 Web technology by M. V. Zelkowitz. Academic press, 2006 2 Discovering Web
2	2 -4	Relationships between HTML, DOM, JavaScript for client-side computation	
3	5-7	PHP, Java and Ruby using a relational database for server-side computation.	

4	8	Design, implementation, and test of a large Web application.	Access Patterns and Trends by applying Olap and data mining technology on web logs by Zaiane O.R., Xin M. Han J. 3 Web Design for Teens by Maneesh Sethi. Course Technology PTR.
5	9-10	XHTML Style Sheets PHP, JavaScript, JavaScript and XHTML Documents	
6	11	Dynamic Documents in JavaScript, Flash, XML, AJAX.	
7 – 9	12	Java Web Software,	
10 – 11	13 – 15	Ruby on Rails	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 403 Electrical Installations and Drafting

Course Time table				
Course Title/Code: **Electrical Installations and Drafting (EEE 403)**	**Name of Lecturers:** **Engr John Tarilayon Afa**	**Class Level:** **400 Level**	**Semester:** **First Semester**	**Duration:** **November 2022– March 2023**

Credit Unit: 2	**Credit hours: 4**	**Class Timing: Wednesdays 2 pm – 4pm** **Thursdays, 4 pm – 6 pm**		

Course Description/Objectives

The course is focus on electrical installation and drafting using CAD tools. It also discussed the regulations guiding installation of electrical components. Also, the design and installation of telecommunication equipment are discussed.

Course Outlines

1. Drafting of electrical and electronic circuits diagrams using CAD tools, such as electronic CAD.
2. Drafting of schematic for electrical and electronic application,
3. Electrical safety, Regulations guiding installation of Electrical and Communications equipment.
4. Design and installation of Telecommunications equipment.
5. Cabling, and lightening protection.
6. Networking topology and Network cabling.

Recommended Texts

1. Electrical Installation Handbook by A. J. Watkins, Chris Kitcher. Newnes. 2007
2. Electrical installation Design by Bill Atkinson, Roger Lovegrove. Wley-Blackwell
3. Electrical installation Calculations-Advance by A. J. Watkins, Chris Kitcher. Newnes

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	design a complete distribution network for different purposes;	Cognitive	5	2	Classwork + Assignment + Attendance
2	apply safety precaution in the design of distribution network;	Cognitive	3	1	Classwork + Assignment + Test + Attendance
3	use the techniques, skills, and modem engineering tools necessary for engineering practice.	Cognitive	3	1	Classwork + Assignment + Test + Attendance
4	Able to interprete electrical regulation regarding installation	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Understanding safety regulation and	Cognitive	2	2	Classwork + Assignment +

	cabling				Attendance

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Lighting design and electrical drafting using CAD Tool	1. Electrical Installation Handbook by A. J. Watkins, Chris Kitcher. Newnes. 2007 2. Electrical installation Design by Bill Atkinson, Roger Lovegrove. Wley-Blackwell 3. Electrical installation Calculations-Advance by A. J. Watkins, Chris Kitcher. Newnes
3 – 5	5 - 6	Drafting of schematic for electrical and electronic applications	
6 - 7	7-8	Electrical safety and regulations guiding electrical and communication equipments	
8 – 9	9-10	Design of Telecommunication equipment	
10	11	Cabling and lightening protection	
11 – 12	12	Networking topology and network cabling	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

500 LEVEL COURSES

EEE 561: Mobile and Wireless Communication

1 Course Time Table				
Course number and Title: **EEE 561** **Mobile and Wireless Communication**	Name of Instructor: **Engr. Dr. David Ebregbe**	Class B.Eng Electrical and Electronic Engineering	Semester First Semester	Duration November 2022– March 2023
Credit hours:	(Theory) 3	**Class Timings:** Wednesday 2pm - 4pm Thursday 10am - 12pm		

3 Course Description/Objectives

This course is an undergraduate level introduction to the fundamentals of wireless transmission systems. Our focus is on the design, analysis and the fundamental limits wireless transmission systems and to develop the foundation for research in this field. The emphasis will be on the basic principles that apply to all systems, rather than the details of any particular current system or standard.

The students should be introduced to the various transmission and reception techniques used in different mobile communication systems, evolution of mobile communication systems from 1G to 5G and beyond

as well as the importance of communication channel in performance of mobile communication system.

3 Course Outlines

Course Outline:

Overview and evolution of wireless communication systems

- Evolution of mobile radio communication 1G -5G
- Standardization bodies
- 1G – 5G Architectures and technologies

Multiple Access Schemes

- FDMA, TDMA, CDMA, OFDMA
- Random Access schemes

Cellular Concepts.

- Frequency reuse
- Cellular system design and Channel assignments
- Interference, SIR and Capacity
- Improving capacity in Cellular systems
- Sectorization and cell splitting

Radio Propagation – wireless Channel

- Transmission problems

1. Free space path loss model
2. 2 ray (plane earth) model
3. Large scale fading – Shadowing
4. Small scale fading – Multipath

Rayleigh/Ricean Fading

5. Generalized path loss model

Path loss + multipath fading + Shadow fading

6. Solution to Transmission problems.

Link Budget analysis and wireless radio channel

Trunking and Grade of service

Testbooks and other Reading Materials

2) Andrea Goldsmith, Wireless Communication. 2005 Cambridge University Press.
3) Wireless Communications, Principles and practice – Theodore S Rappaport, Prentice Hall 2002. Second Edition,
4) A. Molisch. Wireless Communications. Wiley 2011
5) Antennas and Propagation for wireless Communication Systems. Simon R. Saunders, Alejandro Aragon Zavala. Wiley 2007. 2nd Edition.

4 Course Learning Outcomes (CLO's)

S/N	CLO	Domain	Taxonomy level	PEO	Assessment
1	Identify the challenges of radio propagation in the wireless channel and proffer solutions to the transmission problems in the wireless channel.	Cognitive	4	2	Quizzes + Final Exams
2	Describe the basic principles of a wireless communication system and explain the evolution of wireless communication systems, specifically cellular systems from 1G to 5G. The motivations and standardization bodies involved	Cognitive	2	1	Assignment + Final Exam

3	A good analytical, Physical and intuitive understanding of the wireless channel	Cognitive	4	4	Assignment + Final Exam
4	Design and build a robust wireless system	Cognitive	5	3	Assignment + Final Exam
5	Preparation for further study.	Cognitive	3	2	Term Paper
6	Problem solving aspects.	Cognitive	5	3	Quizzes + Assignment + Final Exam

5 Detailed Lecture Plan			
Week No.	**Lecture**	**Course Contents to be Covered**	**Required reading**
		Overview and evolution of wireless communication systems • Evolution of mobile radio	Goldsmith – Chapter 1

1-4	1-8	communication 1G -5G - Types of wireless Communication - Bluetooth, IEEE 802 family of networks • Standardization bodies - Electromagnetic Spectrum • 1G – 5G Architectures and technologies - 4G Coordinated Multipoint Transmission and Reception (CoMP) and Relays - GSM Network Elements - Mobile Terminated Call - GSM, WCDMA, LTE Spectrum allocation and frame structure - 5G ITU user cases	Intro to LTE(C. Cox) – Chapter 1
5 - 6	9 - 12	Multiple Access Schemes and Duplex schemes • FDMA, TDMA, CDMA, OFDMA • Random Access schemes	Goldsmith – Chapter 14
7 - 8	13- 16	Cellular Concepts. • Frequency reuse • Cellular system design and Channel assignments • Interference, SIR and Capacity • Improving capacity in Cellular systems • Sectorization and cell splitting	Goldsmith – Chapter 15

9 -10	**17 - 20**	Radio Propagation – wireless Channel • Transmission problems **7.** Free space path loss model **8.** 2 ray (plane earth) model **9.** Large scale fading – Shadowing **10.** Small scale fading – Multipath Rayleigh/Ricean Fading **11.** Generalized path loss model Path loss + multipath fading + Shadow fading **12.** Solution to Transmission problems.	Goldsmith – chapter 2 Rappaport – Chapter 2 Saunders – Chapter 3 &5
11 - 13	21 - 24	Link Budget analysis and wireless radio channel	Saunders- Chapter 5 Andreas Molisch – chapter 3
14 - 15	25 - 28	Trunking and Grade of service	Saunders – chapter 1 Rappaport – Chapter 2

6. First Semester (2022 -2024 Session)	
Commencement of Classes	14th Aug 2023
Classes End	11th Nov. 2023

Exams Begin		27th Nov. 2023
Exams End		9th Dec. 2023
7. Evaluation Criteria		
Component of Assessment	**Method**	**Marks**
During Semester	Assignments Written Test Attendance	10 10 10
Examination	End of Semester Exam	70
Total		100

EEE 541: Control Engineering II

COURSE TIME TABLE				
Course Title/Code: Control Engineering 2 /EEE 541	Name of Lecturers: Engr. Tebe Larry Ojukonsin	Class Level: 500 Level	Semester: First Semester	Duration: November 2022 – March 2023
Credit Unit: 3	Credit hours: 6	Class Timing: Mon|Thurs 8am- 12pm| 10am-12noon|		

Course Description/Objectives

By the end of this course, students' will be able to model the digital control system in a feedback control loop. Find Z- and Inverse Z-transform of time and laplace functions, and the sampled-data transfer functions. They will be able to reduce an interconnection of sample-data transfer functions to a single sampled-data transfer function and to determine whether a sampled-data system is stable and determine a suitable sampling rates for stability. Also they will be able to design a digital systems to meet steady-state error and transient response specifications (using gain adjustment). Design cascade compensation for digital system. Programme PLC for water treatment with ferrous ion impurities and other automation projects.

Course Outlines

4. Introduction to digital control systems, and the placement of the digital controller in the feedback control loops
5. Digital control of sampled data systems: Block diagram, characteristic roots in the Z-plane.
6. Stability of digital control systems, direct digital design; digital state space formulation and solution of the state equations.
7. Introduction to microcontrollers and microprocessor-based control systems:
8. Introduction to PLC: PLC architectures, PLC programming, AND, OR, LATCH and Timing Function. PLC communication and Interfacing.
9. Fast Fourier Transform and Digital Filters Design.
10. Sampling and Data reconstruction processes: Sampled-data control systems, ideal sampler, sampling theorem, sample and hold operations, frequency domain consideration.
11. Z-transforms: Inverse Properties, applications to solution of differential equations, convolution sums.
12. Stability of discrete systems: Location of Poles, Stability analysis through bilinear transforms.
13. Design of digital control systems: PID controllers and

frequency domain compensation design, state variable methods and the discrete linear regulator problem.

14. Design, implement, and discuss a microprocessor system from a given problem specification.
15. Discuss and implement concepts in automation, communication and IoT applications

Recommended Textbook

1. Control System Engineering (sixth Edition) Norman S. Nise (2011)

2. Programmable Loic Controllers and their Engineering APllications by Alan J. Crispin, McGraw Hill ISBN 0-07-707227-8

3. FluidSIM pneumatic FESTO DIDACTIC demo software download from Web.

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Have knowledge of devices that can be used to implement digital	Cognitive	1	1	Classwork + Assignment + Attendance

	control				
2	Be able to convert first and second order systems to digital systems and then design the gain to meet a transient response and stability specification	Cognitive	2	2	Classwork + Assignment + Attendance
3	Learn basic interfacing and control of I/O devices for Programmable logic Controller	Psychomotor	5	3	Classwork + Assignment + Test + Attendance
4	Learn how to programme PLC				

5	Programme PLC to automate industrial case studies (water Treatment automation to remove ferrous ion inpurities.	Psychomotor	5	3	Classwork + Assignment + Attendance
6	Interprets Piping and Instruments	Psychomotor	5	3	Coursework + Assignment + attendance
7	Design a piping and Instrument drawing for a water treatment process in s/n 5 above.	Psychomotor	5	3	Coursework+Assignment+ Assignment

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References

1	1 – 2	Introduction to digital control systems: Advantages of the digital controller over an analogue system	1. Control System Engineering (sixth Edition) Norman S. Nise (2011) 2. Programmable Loic Controllers and their Engineering Applications by Alan J. Crispin, McGraw Hill ISBN 0-07-707227-8 3. FluidSIM pneumatic FESTO DIDACTIC demo software download from Web.
2 – 3	3 - 4	Modelling the digital controller (computer) in a feedback control system: Modelling the Sampler, and the Zero-Order-Hold	
4 – 5	5 – 7	Analysis of the z- and the inverse z-transform of time and laplace functions	
6 – 8	8 – 10	Evaluation and determination of the sampled-data transfer function, and further reduce an interconnection of sampled-data transfer functions to a single sampled-data transfer function	
9 – 10	11 – 12	Determine whether a sampled-data system is stable and adjust the sampling rates for stability	

11-12	13-14	Design digital system to meet transient specification using gain adjustment, and cascade compensation for digital systems	
13–14	15 – 16	Introduction to Programmable Logic Controller: Ladder diagram programming and industrial case study.	
15	15 – 16	Revision and Course Work defence	
16	Final Semester Examination		

EEE 534: Computer Network and Distributed system (3 Units).

Course Time table				
Course Title/Code: Computer Network and distributed system /EEE 534	Name of Lecturers: Ebipuado Sapre-Obi	Class Level: 500 Level	Semester: Second Semester	Duration: January, 2024 – April, 2024
Credit Unit: 3	Credit hours: 3	Class Timing: Wednesdays 8am – 10am		

Course Description:

The main aim of this course is to introduce the students to the principles, operation and the design heterogeneous networks, their inter-connections in practice, and how digital information flows from source to destination. The course will also study various protocols involved in successful transmission of packets from one end of the globe to the other end via the internet. This will naturally lead to the study of the Open System Interconnect also known as the OSI protocol layers. Towards this end, various network applications and their underlying protocols are discussed. Basics of socket programming enables students to understand the connection between Application Layer to Transport layer for reliable delivery of data. State-of-the-art congestion and flow control algorithms for flow of information over the internet are also taught. Existing routing algorithms concepts for information flow are covered along with the medium access control protocols. Finally, how information moves step by step across various layers of the internet protocol stack to reach the final destination is summarized.

Course Outline

- Introduction and Motivation of networking and communication in IT applications
- Topologies and need for different topologies
- Circuit switching and packet switching
- Need for Protocols, Networking vocabulary
- Basic Overview and Functionalities of the TCP/IP Protocol stack
- Application layer protocols: HTTP, FTP, SMTP
- DNS, Basics of Socket Programming
- Transport Layer –Primitives, Multiplexing / De-Multiplexing, UDP
- Reliable Data Transfer (Selective Repeat, Go-Back-N), TCP – Connection, Flow control and congestion control algorithms Network layer functionalities, Routing Algorithms

- Link State (LS) and Distance Vector (DV) Routing Algorithms IP Addressing: IPV4 and IPV6 packet formats – comparison. Intra-autonomous system routing: RIP, OSPF, Inter-autonomous system routing: BGP
- Mobility at Network Layer, Data Link Layer Functionalities – Forwarding, Flow Control, Error Control, Medium Access Control (MAC) Protocols.
- Taxonomy, channel partitioning, random access, taking turn ,Random Access MAC protocols – Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, Address Resolution Protocol (ARP).

Recommended Textbook

1. Computer Networking: Top-Down Approach, 6th edition by Keith W. Ross, Addison - Wesley 2012
2. Computer Networking : Principles, Protocols and Practice, by Olivier Bonaventure, October 30, 2011
3. Local Area Network, by Gerd Keiser, 2002
4. Performance Analysis of the IEEE 802.11 Distributed Coordination Function, by G. Bianchi, IEEE Journal of Selected Areas in Communications, Vol. 18, No. 3, March 2000.

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understand fundamental concepts of Networks	Cognitive	1	1	Classwork + Assignment + Attendance

2	Have a good grasp of Networking protocols	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Able to distinguish between network types	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Is fully acquainted with OSI Model	Psychomotor	5	3	Classwork + Assignment + Test + Attendance
5	Hands on practical Network SOCKET programming	Psychomotor	5	3	Classwork + Assignment + Attendance

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Introduction, Motivation of networking and communication in IT applications, Topologies and need for different topologies, Circuit switching and packet switching. Need for Protocols, Networking parlance, TCP/IP Protocol Stack – Basic Overview and Functionalities	1. "Computer Networking: Top-Down Approach, 6th edition by Keith W. Ross, Addison - Wesley 2012
2 – 3	3 - 4	Application layer protocols: HTTP, FTP, SMTP Application layer	2. Computer

		protocols, DNS, Basics of Socket Programming	Networking : Principles, Protocols and Practice, by Olivier Bonaventure, October 30, 2011 Local Area Network, by Gerd Keiser, 2002 4. Performance Analysis of the IEEE 802.11 Distributed Coordination Function, by G. Bianchi, IEEE Journal of Selected Areas in Communications, Vol. 18, No. 3, March 2000.
4 – 5	5 – 7	Transport Layer –Primitives, Multiplexing / De-multiplexing, UDP. Reliable Data Transfer (Selective Repeat, Go-Back-N), TCP – Connection, Segment Structure	
6 – 8	8 – 10	Flow control and congestion control algorithms – Week 8 – Network layer functionalities, Routing Algorithms – Link State (LS) and Distance Vector (DV) Routing Algorithms	
9 – 10	11 – 12	IP Addressing: IPV4 and IPV6 packet formats – comparison Weeks 10 & 11 – Intra-autonomous system routing: RIP, OSPF, Inter-autonomous system routing: BGP, Mobility at Network Layer	
11-12	13-14	Data Link Layer Functionalities – Forwarding, Flow Control, Error Control, Medium Access Control (MAC) Protocols: Taxonomy, channel Partitioning, random access, taking turn Weeks 13 & 14 - Random Access MAC protocols – Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, Address Resolution Protocol (ARP)	
13–14	15 – 16	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE 573: Electric Drives

Course Time table				
Course Title/Code: **Electric Drives (EEE 573)**	**Name of Lecturers:** **Dr Ajabuego Goodleaf Oluchi**	**Class Level:** **500 Level**	**Semester:** **First Semester**	**Duration:** **November 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Tuesday 12pm – 2pm** **Friday 4pm – 6pm**		

Course Description/Objectives
Principles of Electric Drive components, Ward Leonard speed control schemes, Torque and speed control, motor braking, power rating selection. Introduction to AC/DC, DC/AC, and DC/DC conversion. Industrial drives: choice of an electric motor for industrial application, specification of control system, duty performance, criteria, motor dynamics: control characteristic of shunt motors, two-phase servo motor, stepper motor and gearless system, protection of drive motors. Block diagram and models of Industrial drives.
Course Outlines
2. Principle of Electric Drive Components **3.** Speed control schemes and motor braking **4.** Introduction to AC/DC, DC/AC and DC-DC conversion

5. Industrial drives and applications
6. Drive control and specification of Control systems, and characteristics
7. Protection of drive motors
8. Models of Industrial drives

Recommended textbooks

1 Advanced Electric Drives: Analysis, Control, and modelling using MATLAB/Simulink by Ned Mohan Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Published simultaneously in Canada
2 Best Practice Manual Electric Motors By Devki Energy Consultancy Pvt. Ltd., 405, Ivory Terrace, R.C. Dutt Road, Vadodara – 390007, India.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Determine and examine the various uses of electric drives in industrial and domestic areas	Cognitive	5	2	Classwork + Assignment
2	Able to use knowledge from electrical	Cognitive	3	2	Classwork + Assignment +

	machines, power electronics and control to drive and automate industrial systems network.				Attendance
3	Able to classify the different types of electrical drive systems	Cognitive	3	1	Classwork + Assignment + Attendance
4	Analyse the characteristic of shunt, series and separately excited motor speed and torque characteristics	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Identify the critical areas in application levels, and derive typical solutions.	Cognitive	2	2	Classwork + Assignment + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Principle of Electric drive Component ✓ Understand electric drive component ✓ Understand how each component of the drive system works.	1) Advanced Electric Drives: Analysis, Control, and modelling using MATLAB/Simulink by Ned Mohan Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Published simultaneously in Canada 2) Best Practice Manual Electric Motors By Devki Energy Consultancy Pvt. Ltd., 405, Ivory Terrace, R.C. Dutt Road, Vadodara – 390007, India.
2	2	Speed control schemes ✓ Understand the Ward Leonard speed control and voltage control schemes	
3	3	AC/DC, DC/AC, and DC/DC conversion. ✓ Understand the principle of rectifiers (AC/DC) and DC/AC ✓ Understand DC/DC conversion such as step down and step up chopper circuit ✓ Solve for the average voltage value for half and full wave and bridge rectifiers and inverters.	
4	4	Choice of an electric motor for Industrial drives and applications	

5	5-6	Drive control and specification of Control systems, and characteristics ✓ Understand the dynamic control characteristic of shunt motors, two-phase servo motor, stepper motor and gearless system	
6	7	Protection of drive motors	
7 – 9	8 – 11	Models of Industrial drives	
10 – 11	12 – 15	Torque, Speed and power rating selection of motor drive	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 587: Power System Faults and Protection

Course Time table				
Course Title/Code: **Power System Faults and**	**Name of Lecturers:** **Professor**	**Class Level:** **500**	**Semester:** **First**	**Duration:** **November 2022 – March, 2023**

Protection (EEE 587)	**Anthony Ogbonanaya Ibe**	**Level**	**Semester**	
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Tuesday 2pm – 4pm** **Wednesday 12pm – 2pm**		

Course Description/Objectives
The objectives of the course is to discuss and appreciate why buildings, equipment's in substation/Substations are been grounded. It will First introduces the students to Generation System, Transmission System and Distribution System and give them a guide of what the entire power system looks like. It also addresses the likely faults that arise from the systems and the protection schemes so desired for effective protection of the Power system. It also list the importance of protective system in power Systems and give a firm understanding of impending faults in the Power System and avert same where possible. The course also Proffer continuity of power supply and what it takes to achieve that in the power system
Course Outlines
1 Fault analysis - types of faults. Overhead line faults, cable faults 2 Neutral grounding and earthling systems 3 The concept of protective relaying in power systems. 4 Distance relaying 5 Three phase symmetrical components theory and unbalanced faults analysis 6 Differential relaying protective systems in generators, motors,

buss bars and transformers

7 Basic principles of relay design, construction, characteristics, applications and testing.

Recommended textbooks

1 Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York

2 Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering. USA.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Understand the various faults in the Power system, majorly Insulation fault, Electrical, Thermal and Mechanical fault and their causes.	Cognitive	2	2	
2	Understand and appreciate why buildings, equipment's in substation/Substations are been grounded. Further understand the earthling system using earth rod, mesh,	Cognitive	2	2	

	bentonite, they also understand why granites are poured on the switchyard of a substation				
3	Understand line compensation to achieve maximum power transfer capability of the system as far as possible, remove Ferranti effect, to achieve high degree of system stability margin also compensation of capacitive earth current using neutral grounding reactor (NGR) to regularize the excessive current that would flow to the earth.	Cognitive	2	2	Classwork + Assignment + Attendance
4	Analyse the use Capacitor banks and why they are installed mostly in the high voltage side in the substation	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Appreciate the importance of shunt capacitors and series	Cognitive	5	3	Classwork + Assignm

	capacitors and their importance to improvement of Power factor, decreases KVA loading on source				ent + Attendance
6	Understand the importance and function of relaying in the protection of power system, viz sounding alarm for operator to take some corrective action or measure to close the trip circuit or circuit breaker in order to disconnect a component or equipment during an abnormal fault condition,	Cognitive	2	2	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**

1	1	Power system fault analysis ✓ Understand the different types of faults such as overhead faults, cable faults, etc. ✓ Solve problem involving different types of faults..	1) Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering. USA. (2) Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York .
2	2	Neutral grounding and earthling systems	
3	3	The concept of protective relaying in power systems.	
4	4	The concept of Distance relaying	
5	5-6	Differential relaying protective systems in generators, motors, buss bars and transformers	
6	7	Compensation of capacitive earth current	
7 – 9	8 – 11	Basic principles of relay design, construction, and characteristics	
10 – 11	12 – 15	Applications and testing of protective relay	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	

	Final Semester Examination

EEE 584 Renewable energy Design

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
Renewable Energy Design (EEE 584)	**Engr Dr. Priye Kenneth Ainah**	**500 Level**	**Second Semester**	**April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Mondays 8 am – 10am** **Wednesdays, 12.00 pm – 2.00 pm**		

Course Description/Objectives
The course is focus on application of semiconductor on power control, switching, power diode, transistors, thyristors, GTO and their characteristics. It also discussed DC-DC converters and AC/DC inverter and different topologies. Also, harmonics and ower quality are discussed.
Course Outlines
1 Introduction to weather data resources: declination and variation over a year. Solar time, solar hour angle and air

mass.

4. Estimation of solar radiation on the earth surface at a given location, and measurement of weather data.
5. Types of photovoltaic (PV) systems/configurations: standalone and grid integrated systems with batteries and back up.
6. Building integrated PV system design.
7. Consideration for PV system sizing: load evaluation, solar resources, PV model, storage system sizing, auxiliary power, Charge controller specification, sitting issues and cost constraints.
8. Critical issues for load evaluation. Issues to consider when selecting PV model.
9. Standard PV module characteristics.
10. Solar thermal system design: solar energy collectors, components of solar water heating system. Types of solar collectors: Flat plate and Evacuated collectors. Heat losses of flat plate collectors, collector efficiency. Common configurations of water heating systems. Modelling of solar heating system: model of heat exchanger, model of storage tank and estimation of storage water temperature.
11. Wind turbine design: power converters for variable speed turbine. Design of wind turbine blades, angle of lift. Blade loads

Recommended Texts

1 Renewable energy system design by Ziyad Salameh. Academic Press. 2011

2 Solar Engineering of Thermal Processes by John A. Duffie, William A, Beckman. John Wiley and sons. 2011

3 Photovoltaic system Design: Procedures, Tools and Applications by Deambi Suneel. CRC Press. 2016

COURSE LEARNING OUTCOMES (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Comprehend the energy and energy types; and adverse consequences of greenhouse gases.	Cognitive	2	2	Classwork + Assignment + Attendance
2	make interpretation about the solar irradiation	Cognitive	3	2	Classwork + Assignment + Test + Attendance
3	Explain the different types of photovoltaic (PV) configuration	Cognitive	5	2	Classwork + Assignment + Test + Attendance
4	design standalone and grid connected electric power from renewable sources	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	explain the production of	Cognitive	5	3	Classwork + Assignment

	electricity from wind energy;				+ Attendance
6	Design of solar thermal system	Cognitive	5	3	

Detailed Lecture Plan

Week No	Lecture	Course Content to be Covered	References
1 – 2	1 – 4	Introduction to weather data resources: declination and variation over a year. Solar time, solar hour angle and air mass.	1. Renewable energy system design by Ziyad Salameh. Academic Press. 2011 2. Solar Engineering of Thermal Processes by John A. Duffie, William A, Beckman. John Wiley and sons. 2011 3. Photovoltaic system Design: Procedures, Tools and Applications by Deambi Suneel. CRC Press. 2016
3 – 5	5 - 6	Estimation of solar radiation on the earth surface at a given location, and measurement of weather data.	
6 - 7	7-8	Types of photovoltaic (PV) systems/configurations: standalone and grid integrated systems with batteries and back up.	
8 – 9	9-10	Consideration for PV system sizing: load evaluation, solar	

		resources, PV model, storage system sizing, auxiliary power, Charge controller specification, sitting issues and cost constraints.	
10	11	Solar thermal system design: solar energy collectors, components of solar water heating system. Types of solar collectors	
11 – 12	12	Wind turbine design: power converters for variable speed turbine. Design of wind turbine blades, angle of lift. Blade loads	
13-14	13-14	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE-588 Power System Design

Course Time table				
Course Title/Code:	**Name of Lecturers:** **Prof Anthony**	**Class Level:**	**Semester:**	**Duration:** **April, 2023**

Power System Design (EEE 588)	**O. Ibe**	**500 Level**	**Second Semester**	**– July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Tuesday 10am – 12pm** **Wednesday 2pm – 4pm**		

Course Description/Objectives
The course provides a comprehensive knowledge on the design procedures and factors affecting power system design. We will also look at sag calculation, types and layout of substation; overhead lines and cables; fabrication, types of service poles and erection. It also differentiates the concept of power system planning, design and analysis. It gives a comprehensive knowledge on the types of substation and layout.
Course Outlines
1 Over view of world energy resources; **2** Power system planning and design **3** Methods of electricity generation, transmission, distribution, and load forecasting 4 Principles and practice of High voltage transmission and distribution 5 Mathematical methods used in planning of source utilization and transmission networks 6 Generation scheduling of power system equipment.

Alternators

7 Factors affecting size and design, special problems of turbo- and hydro-alternator construction and operation.

8 Transformer design, construction and operation switchgear.

9 Principles of circuit breaking, types and layout of substation; overhead lines and cables; fabrication, erection and use

Recommended textbooks

2 Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York

3 Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering. USA.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Have in-dept knowledge on the factors affecting power system design	Cognitive	2	2	
2	Design system components using calculated	Cognitive	5	3	Classwork + Assignment + Attendance

	parameters				
3	Design and construct transformer	Cognitive	5	3	Classwork + Assignment + Attendance
4	Determine sag, cable and sizes, types of poles and erection	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Understand the types of substation and layout.	Cognitive	2	2	

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Over view of world energy resources	1) Power system analysis and design fifth Edition by J, Duncan Glover, Mulukutla, S. Sarma, Thomas J. Overbye. Global Engineering.
2	2	Power system planning and design, methods of Electricity generation, transmission and distribution and load forecasting	
3	3	Mathematical methods used in planning of source utilization and transmission networks.	

4	4	Generation scheduling of power system equipment.	USA. (2) Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York .
5	5-6	Alternators; Factors affecting size and design, special problems of turbo-and hydro-alternator construction and operation	
6	7	Transformer design, construction and operation switchgear	
7 – 9	8 – 11	Principles of circuit breaking, types and layout of substation	
10 – 11	12 – 15	Overhead lines and cables; fabrication, erection and use.	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE-504 Reliability and Maintainability

Course Time table				
Course Title/Code:	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**
Reliability and Maintainability (EEE 504)	**Professor Donatus Bassey**	**500**	**Second Semester**	**April, 2023 – July, 2023**

		Level		
Credit Unit: 3	**Credit hours: 4**	**Class Timing:** **Thursday 10am – 12pm** **Friday 4 pm – 6 pm**		

Course Description/Objectives
The course aims to provide students with an understanding of the concept of maintenance and reliability on computer hardware and software, communications and power equipment, and other engineered system. The course will introduce student to the different types of maintenance scheduling techniques; quality of service (QoS) and quality control issues. The objectives of the course are to introduce basic concept of maintenance and reliability, introduce various methods of reliability analysis with real time problems, discuss the application of maintenance strategies in manufacturing industries and to understand the international standard organization 900 quality requirement
Course Outlines
1 Introduction to reliability, maintainability, and reliability specifications 2 Application to computer hardware and software, communications and power equipment and other engineered system 3 Basic maintenance type and procedure and maintenance scheduling technique 4 Principles and practice of High voltage transmission and distribution 5 Analysis of quality of service (QoS) and quality control issues

6 Design for high reliability, software quality assurance
7 International Standard organization (ISO) 9000 quality requirements
8 Total quality management.

Recommended textbooks

1 Reliability Evaluation of Power Systems Second Edition by Roy Billinton and Ronald N. Allan. Plenum Press • New York And London
2 Handbook of Reliability, Availability, Maintainability and Safety in Engineering Design by Rudolph Frederick Stapelberg. Springer. 2009

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Develop ability in formulating suitable maintenance strategies to enhance system reliability	Cognitive	5	3	Classwork + Attendance
2	Apply the reliability concepts in managing the manufacturing sector with	Cognitive	5	2	Classwork + Assignment + Attendance

	highest possible level of reliability availability				
3	Apply statistical tools to characterize the reliability of an item.	Cognitive	5	2	Classwork + Assignment + Attendance
4	Determine the reliability of a system	Cognitive	5	3	Classwork + Assignment + Test + Attendance
5	Establish maintenance strategies according to system characteristic and design transition programs to actualize these programs	Cognitive	4	3	

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Over view of world energy	

		resources	
2	2	Power system planning and design, methods of Electricity generation, transmission and distribution and load forecasting	1 Reliability Evaluation of Power Systems Second Edition by Roy Billinton and Ronald N. Allan. Plenum Press • New York And London 2 Handbook of Reliability, Availability, Maintainability and Safety in Engineering Design by Rudolph Frederick Stapelberg. Springer. 2009.
3	3	Mathematical methods used in planning of source utilization and transmission networks.	
4	4	Generation scheduling of power system equipment.	
5	5-6	Alternators; Factors affecting size and design, special problems of turbo-and hydro-alternator construction and operation	
6	7	Transformer design, construction and operation switchgear	
7 – 9	8 – 11	Principles of circuit breaking, types and layout of substation	
10 – 11	12 – 15	Overhead lines and cables; fabrication, erection and use.	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 586: Power System Economic and Operations

Course Time table				
Course Title/Code: **EEE 586: Power System Economic and Operations (EEE 586)**	**Name of Lecturers:** **Engr. James Karimo Sokari**	**Class Level:** **500 Level**	**Semester:** **Second Semester**	**Duration:** **April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 3**	**Class Timing: Monday 12pm – 2pm** **Wednesday 12pm – 2pm**		

Course Description/Objectives
The course is focused on the principle and operation of power generating system, control (voltage and frequency controls) and the economic operation of the generating systems (unit). Economic principles, cost equations, power factor and the effect power transmission on the economy of the system will be discussed. The course will discuss the principle and operation of the electrical power generating system and how power system operating policies might have a long-term impact on consumers and society. It also describe the cost equations of generating plants, and analyse economic operation of the generating plant. The course will also analyse the

effect of power factor on generating plant economic. Development of tariff model for power system and describe the impact of frequency and voltage control in power system operation.

Course Outlines

4 Analyse an optimal operation setup of power system which minimizes operation costs and meet desired needs.
5 Identify optimal operation setup, design problem and constraints that include the economic, and operability
6 Using analytical tools to help in the optimal operation setup.
7 Formulate power system operation problem as a mathematical model.
8 use of knowledge of contemporary economic issues in tackling the power system operation problem.
9 use of knowledge of contemporary technological issues in tackling the power system operation problem..

Recommended textbooks

1 Power system operations and electricity markets by Fred I. Denny, David I. Dismukes. CRC Press
2 Power system operations by Anthonio J. Conejo, Luis Baringo. Springer, 2018
3 Power system economic and market operations by Zhong Jin. CRC Press
4 Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Analyse an optimal operation	Cognitive	5	2	

	setup of power system which minimizes operation costs and meet desired needs.				
2	Identify optimal operation setup, design problem and constraints that include the economic, and operability	Cognitive	5	3	
3	Using analytical tools to help in the optimal operation setup.	Cognitive	2	2	Classwork + Assignment + Attendance
4	Formulate power system operation problem as a mathematical model.	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Use of knowledge of contemporary	Cognitive	5	3	Classwork + Assignment +

	economic issues in tackling the power system operation problem				Attendance
6	Use of knowledge of contemporary economic issues in tackling the power system operation problem.	Cognitive	3	2	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Principles and operations of power generating systems	1 Power system operations and electricity markets by Fred I. Denny, David I. Dismukes. CRC Press
2	2	components of power generating systems, and types of stations	
3	3	The concept of protective relaying in power systems.	
4	4	Design and organization of voltage and frequency controls	

5	5-6	Load curve studies, Economic principles, cost equations, economic operation of generating plants,	2 Power system operations by Anthonio J. Conejo, Luis Baringo. Springer, 2018 3 Power system economic and market operations by Zhong Jin. CRC Press 4 Power system Analysis by Hadi Saadat, WCB McGraw-Hill Companies, Schuam's, 11 west 19th street. New York.
6	7	Effect of transmission on economy of systems	
7 – 9	8 – 11	Electrical load development	
10 – 11	12 – 15	Tariffs, load duration curves; effect of power factor on plant economy.	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 531: Microprocessors Applications

COURSE TIME TABLE				
Course Title/Code:	Name of Lecturers:	Class Level:	Semester:	Duration:
Microprocessor Applications /EEE 531	Jenny Fawei	500 Level	First Semester	November 2022 – March, 2023
Credit Unit: 3	Credit hours: 8	Class Timing: Tuesdays 2pm – 6pm		

Course Description:

This course consists of two parts. The first part studies microcontroller architectures, C programming or Assembly language and resources, and how to apply these to real-world design problems using the Arduino, Raspberry pi and ESP 32/8266 Microcontrollers. Microcontrollers will be interfaced with GSM and WiFi modules do develop/implement application in areas such as; Automations, Security, Control, IoT Applications etc. The second part consists of students projects requiring both hardware and software design, solving a practical problem, and incorporating elements from the lecture. Course Hours Per Week: Class, 2. Lab, 3. Semester Hours Credit, 3.

Course Outline

- Analyze Microcontroller real-time Applications in

Engineering, health care, security and so on.

- Analyze and synthesize the hardware and software organization of a microprocessor system
- Interfacing with input and output devices
- Discuss, manipulate, and control microprocessor system Input / Output and peripherals
- Microprogramming and Assembly language instructions
- Design, implement, and discuss a microprocessor system from a given problem specification.
- Discuss and implement concepts in automation, communication and IoT applications

Recommended Textbook

1. Fundamentals of Microprocessor and Microcontrollers by B. Ram, Dhanpat Rai Publication, Bangalore.

2. Microprocessor Applications by Donald Stevenson and Keith Miller. Published by Wiley India

3. Programming Arduino: Getting Started with Sketches (second edition) by Simon Monk.

Developing IoT Projects with ESP32: Unlock the full Potential of ESP32 in IoT development to create production-grade smart devices by Vedat Ozan Oner. Publisher: Packt Publishing; 2nd edition November 30, 2023

Course Learning Outcomes (CLOs)					
S/	CLO	Domain	Taxonom	PE	Assessmen

N			y Level	O	t
1	Discuss the various aspects microprocessor / Microcontroller applications	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have good knowledge of Microcontroller I/O devices and their areas of applications	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Learn how to write program for specific microcontroller	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Learn basic interfacing and control of I/O devices and peripherals	Psychomotor	5	3	Classwork + Assignment + Test + Attendance
5	Design and implementation of Microcontroller systems	Psychomotor	5	3	Classwork + Assignment + Attendance
6	Executing	Psychomoto	5	3	Coursewor

	projects on Microcontroller applications	r			k + Assignment + attendance

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Discuss the real-time applications of Microcontroller in Engineering, health sector, commence and other areas.	1. Fundamentals of Microprocessor and Microcontrollers by B. Ram, Dhanpat Rai Publication, Bangalore. 2. Microprocessor Applications by Donald Stevenson and Keith Miller. Published by Wiley India 3. Programming Arduino: Getting Started with Sketches (second edition) by Simon Monk. 4. Developing IoT Projects with
2 – 3	3 - 4	Analyze and synthesize the hardware and software organization of a microprocessor system	
4 – 5	5 – 7	Learning programming structures and syntaxes for Arduino and Raspberry pi	
6 – 8	8 – 10	Interfacing Microcontroller with input and output devices using the Arduino uno, sensors and LCDs	

9 – 10	11 – 12	Interfacing Microcontrollers with GSM and WiFi modules	ESP32: Unlock the full Potential of ESP32 in IoT development to create production-grade smart devices by Vedat Ozan Oner. Publisher: Packt Publishing; 2nd edition November 30, 2023
11-12	13-14	Hand-On projects: Design and implementation of Microcontroller systems using hardware and software	
13–14	15 – 16	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

FCE 571: Engineering Economics and Management

Course Time table				
Course Title/Code: Engineering	Name of Lecturers:	Class Level:	Semester: First	Duration: November,

Economics and Management/FC E 571	Prof. A.N. Okpala Dr. Agonga Oyinbonogha Fred Dr. Sibete Godfrey	500 Level	Semester	2022 – March, 2023
Credit Unit: 2	Credit hours: 4	Class Timing: Wednesdays 10am – 12noon Fridays 8am – 10am		

Course Description/Objectives
Engineering Economics and Management gives an understanding of how Economics and management relates to Engineering especially the technical part of Engineering. This course will help students understand better the time value of money basically for decision making as well as the process of leading and directing.
Course Outlines
1. Understanding the Nature and Scope of Economics, Basic Concepts in Engineering Economics. 2. Applying the Techniques for Analyzing Capital investments. 3. Evaluation of public alternatives, Replacement Analysis, Make or buy decision. 4. Understanding the concept, principles and functions of Management. 5. Evaluating Personnel management; objectives and functions,

recruitment and selection personnel development.
6. Evaluating Financial management; sources of financial accounting and book keeping, cost planning and control.
7. Understanding the concept, principles and structure of a business Organization

Recommended textbooks

1. Sepulveda, Jose A. Schaum's Outline of Theory and Problems of Engineering Economics. Copyright 1984 by The McGraw-Hill Companies. ISBN 0-07-023834-0
2. Engineering Management by B S, Dhillon, Technornic Publishing Co., 1987.
3. Essentials of Management by Joseph L. Massie, Prentice hall Publishing Co., 4 th Edition.
4. Engineering Management by D.I. Cleland and D. E Kocaoglu, McGraw-Hill, 1981.

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Understanding the Nature and Scope of Economics, Basic Concepts in Engineering	Cognitive	2	1	Classwork + Assignment + Test + Attendance

	Economics.				
2	Applying the Techniques for Analyzing Capital investments	Cognitive	3	1	Classwork + Assignment + Test + Attendance
3	Evaluation of public alternatives, Replacement Analysis, Make or buy decision	Cognitive	5	1	Classwork + Assignment + Test + Attendance
4	Understanding the concept, principles and functions of Management.	Cognitive	2	1	Classwork + Assignment + Test + Attendance
5	Evaluating Personnel management; objectives and functions, recruitment and selection personnel	Cognitive	5	1	Classwork + Assignment + Test + Attendance

	development				
6	Evaluating Financial management; sources of financial accounting and book keeping, cost planning and control.	Cognitive	5	1	Classwork + Assignment + Test + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1 – 2	Basic Concepts –Engineering Economics a) Introduction b) The Time Value of Money c) Interest and Interest rate d) Simple Interest and Compound Interest e) Inflation and Taxation f) Cash Flows (Discounted	1. Sepulveda, Jose A. Schaum's Outline of Theory and Problems of Engineering Economics. Copyright 1984 by The McGraw-Hill Companies. ISBN 0-07-023834-0

		and Compounded)	2. Engineering Management by B S, Dhillon, Technornic Publishing Co., 1987. 3. Essentials of Management by Joseph L. Massie, Prentice hall Publishing Co., 4 th Edition. 4. Engineering Management by D.I. Cleland and D. E Kocaoglu, McGraw-Hill, 1981.
2 – 3	3 – 5	Techniques for analyzing capital investment – Compounding Periods a) Annual Compounding b) Discrete and Periodic Compounding c) Continuous Compounding d) Present Worth and Future Worth	
4 – 5	6 – 8	Techniques for analyzing capital investment a) Net Present Worth, b) Rate of Returns, c) Payback Period, d) Benefit-Cost Ratio	
6 – 8	9 – 11	Evaluation of public alternatives, Replacement Analysis, Make or buy decision, Understanding the concept, principles and functions of Management.	

9 – 11	12 – 14	Evaluating Personnel management; objectives and functions, recruitment and selection personnel development. Evaluating Financial management; sources of financial accounting and book keeping, cost planning and control.	
12 – 14	15 – 18	Understanding the concept, principles and structure of a business Organization) Explain main factors affecting productivity.Write a detailed note on productivity and methods for measuring the productivity.	
15	19 – 20	Revision	
16	**Final Semester Examination**		

EEE 585: High Voltage Engineering II

Course Time table				
Course Title/Code: **High Voltage Engineering**	**Name of Lecturers:**	**Class Level:**	**Semester:** **First**	**Duration:** **November**

II (EEE 585)	**Engr. John Tarilayon Afa**	**500 Level**	**Semester**	**2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Thursday 8am – 10am** **Thursday 10am –1 2pm**		

Course Description/Objectives
The course focuses on arc mechanism, extinction effect on current interruption, dielectric breakdown, thermal and electrodynamic effect on short circuit currents. Also, we will look at pollution of insulators, insulating materials and their properties for high voltage protection. The objectives are to analyze the arc mechanism and its extinction effect on current interruption, describe and analyze the breakdown in solid and liquid dielectrics, describe the various type of switches and breakers, describe insulating materials, structure and properties applied to high voltage systems, and to describe the characteristic and operation of insulators and the effect of the environment on its performance.
Course Outlines
1 Arc mechanism and its extinction effect of circuit conditions on current interruption. 2 Breakdown in solid and liquid dielectrics. Switchgear construction, oil switches. 3 Minimum oil breakers; air blast and SF6 types. 4 Thermal and electrodynamics effects of short circuit currents

5 Arc extinguishing devices, resistance switching. Introduction to conducting, magnetic and insulating materials, such as ceramics, structure and properties of thin films
6 Characteristics of dielectric materials applied to high voltage systems.
7 Conducting material and introduction to superconductivity
8 Buss Bar arrangement and operation

Recommended textbooks

1 High Voltage Engineering, fundamental by E. Kuffel, W.S. Zaengl and J. Kuffel
2 Advances in High Voltage Engineering by IET Power and Energy Series 40
3 High Voltage Engineering: Theory and Practice second Edition by Mazen Abdel Salam, Hussein Anis, Ahdab El-moshedy and Rashdy Radwan

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Analyze the impact of pollution on high voltage protection device (insulator) on the power system	Cognitive	5	3	

2	Analyze the thermal and electrodynamic effect of short circuit current	Cognitive	5	2	
3	Describe the characteristics of dielectric materials applied to high voltage systems	Cognitive	5	2	Classwork + Assignment + Attendance
4	Classify and differentiate the different types of breakers used in high voltage systems.	Cognitive	4	3	Classwork + Assignment + Test + Attendance
5	Analyze arc mechanism and its extinction effect on circuit conditions on current interruption	Cognitive	4	3	Classwork + Assignment + Attendance

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Arc mechanism and its extinction effect of circuit conditions on current interruption	1) High Voltage Engineering, fundamental by E. Kuffel, W.S. Zaengl and J. Kuffel 2) Advances in High Voltage Engineering by IET Power and Energy Series 40 3) High Voltage Engineering: Theory and Practice second Edition by Mazen Abdel Salam, Hussein Anis, Ahdab El-moshedy and Rashdy Radwan.
2	2	Breakdown in solid and liquid dielectrics. Switchgear construction, oil switches.	
3	3	Minimum oil breakers; air blast and SF6 types. Transient recovery voltages.	
4	4	Thermal and electrodynamics effects of short circuit currents. Arc extinguishing devices, resistance switching.	
5	5-6	Introduction to conducting, magnetic and insulating materials, such as ceramics, structure and properties of thin films	
6	7	characteristics of dielectric materials applied to high voltage systems	
7 – 9	8 – 11	conducting material and introduction to superconductivity	
10 – 11	12 – 15	Buss Bar arrangement and operation.	

12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE-563: Modern Communication Systems

Course Time table				
Course Title/Code: **Modern Communication Systems (EEE 563)**	**Name of Lecturers:** **Dr Diton Geku**	**Class Level:** **500 Level**	**Semester:** **First Semester**	**Duration:** **November 2022 – March, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Wednesday 12pm – 2pm** **Thursday 8am – 10am**		

Course Description/Objectives
This course will describe the element of digital communication, Pulse-amplitude and pulse-time modulation, PCM, DPCM and Delta-modulation. TDM systems, source coding, channel coding,

modulation/demodulation, Information and channel capacity: Discrete communication channels and their analysis. It will also focus on Stochastic Process, Markov process, Poisson process, Ergodic Process, Optimum Receivers, Demodulator, Optimum detector, ML sequence detector, Probability of error for binary modulation techniques, Software Defined Radio (SDR), and MIMO Systems.

Course Outlines

1. Elements of digital communication systems: Sampling theorem, Sampling and quantization of band limited signals.
2. Pulse-amplitude and pulse-time modulation, PCM, DPCM and Delta-modulation. TDM systems, source coding, channel coding, modulation/demodulation, Information and channel capacity: Discrete communication channels and their analysis. Base-band transmission of analog signals.
3. Time division multiplexing of digital signals. Synchronization methods. Information Theory and signal coding, Hoffman code, error correction and detection.
4. Stochastic Process: Introduction, Mathematical definition of a stochastic process, Mean-Square Stochastic Integrals, Mean-Square Stochastic Differential Equations, Markov process, Poisson process, Ergodic Process.
5. Optimum Receivers: Optimum receivers for signals corrupted by additive white Gaussian noise, Correlation
6. Demodulator, Optimum detector. ML sequence detector, Probability of error for binary modulation techniques
7. Software Defined Radio (SDR): Need for software radio, general structure for transceiver for SDR, third generation SDR system architecture, trends in SDR, cognitive radio, spectrum sensing in cognitive radio.
8. MIMO Systems: Introduction, space diversity and systems based on space diversity, MIMO based system architecture, MIMO channel modeling, MIMO channel measurement, MIMO channel capacity

Recommended textbooks

1	Principles of communication systems simulation with wireless applications by William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar
2	Cmmunications Systems by A, Bruce Carlson, Paul Crilly, Janet Rutledge. McGraw-Hill

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Comprehend various digital modulation techniques.	Cognitive	2	2	
2	Explain the concept of Multicarrier Modulation.	Cognitive	2	2	
3	Analyze errors in system using optimum receivers and detectors.	Cognitive	5	2	Classwork + Assignment + Attendance
4	Gives an introduction to the theory of stochastic processes.	Cognitive	4	3	Classwork + Assignment + Test + Attendance

5	Contribute in the areas of software defines radio and cognitive radio.	Cognitive	4	3	Classwork + Assignment + Attendance
6	Understand MIMO systems and channel modeling.	Cognitive	2	2	

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1	Elements of digital communication systems: Sampling theorem, Sampling and quantization of band limited signals.	1 Principles of communication systems simulation with wireless applications by William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L.
2	2	Pulse-amplitude and pulse-time modulation, PCM, DPCM and Delta-modulation. TDM systems, source coding, channel coding, modulation/demodulation, Information and channel capacity: Discrete communication channels and their analysis. Base-band transmission of analog signals	

3	3	Time division multiplexing of digital signals. Synchronization methods. Information Theory and signal coding, Hoffman code, error correction and detection.	Kosbar 2 Cmmunications Systems by A, Bruce Carlson, Paul Crilly, Janet Rutledge. McGraw-Hill.
4	4-5	Stochastic Process: Introduction, Mathematical definition of a stochastic process, Mean-Square Stochastic Integrals, Mean-Square Stochastic Differential Equations, Markov process, Poisson process, Ergodic Process.	
5	6	Optimum Receivers: Optimum receivers for signals corrupted by additive white Gaussian noise, Correlation	
6	7	Demodulator, Optimum detector. ML sequence detector, Probability of error for binary modulation techniques	
7 – 9	8 – 11	Software Defined Radio (SDR): Need for software radio, general structure for transceiver for SDR, third generation SDR system architecture, trends in SDR, cognitive radio, spectrum sensing in cognitive radio.	
10 – 11	12 – 15	MIMO Systems: Introduction, space diversity and systems based on space diversity, MIMO based system	

		architecture, MIMO channel modeling, MIMO channel measurement, MIMO channel capacity	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	
	Final Semester Examination		

EEE 555: Electronics System Design

Course Time Table				
Course Title/Code: Electronics System Design/EEE 555	Name of Lecturers: Gabriel, E. Moses	Class Level: 500 Level	Semester: First Semester	Duration: November 2022– March 2023
Credit Unit: 3	Credit hours: 8	Class Timing: Thursday 2pm – 6pm		

Course Description/Objectives
This course consists of two parts. The first part studies Transistors and their applications in the design of various amplifiers. Simulations using different software environments and their applications of these to real-

world design problems using the Arduino, Raspberry pi and ESP 32/8266 Microcontrollers. The use of DSP in designing and solving real-life problems. Different design of wireless transceiver architectures. Case studies of Video and TV receivers.

The second part consists of students' projects requiring both hardware and software design, solving a practical problem, and incorporating elements from the lecture. Course Hours Per Week: Class, 2. Lab, 3. Semester Hours Credit, 3.

Course Outlines

1. Analyze Transistor amplifier design. Stability at high frequencies.
2. Oscillators, power amplifier design.
3. Simulations using different software environments and their applications of these to real-world design problems using different MCUs'
4. Introduction to the use of DSP is system design
5. Design, implement, and discuss an analog/digital system with enhancements using microcontroller system from a given problem specification.
6. Discuss and implement concepts in automation and communication.

Recommended textbooks

3 Experiments in Electronics Fundamental and Electric Circuits by David Buchla
4 Fundamentals of Digital Signal Processing
5 Microwave Power Amplifier Analysis and Design by Lawrence J. Kushner
6 Microprocessor Applications by Donald Stevenson and Keith Miller. Published by Wiley India
7 Programming Arduino: Getting Started with Sketches (second edition) by Simon Monk.
8 Fundamentals of Industrial Electronics: Edited by Bogdan M. Wilamowsky and J. David Irwin

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessment
1	Discuss the Fundamentals of Transistors, oscillators and their applications	Cognitive	1	1	Classwork + Assignment + Attendance
2	Have a working knowledge of amplifiers and their areas of applications	Cognitive	2	2	Classwork + Assignment + Test + Attendance
3	Learn to design various types of amplifiers	Cognitive	3	2	Classwork + Assignment + Test + Attendance
4	Learn basic software applications in the simulation and design of amplifiers	Psychomotor	5	3	Classwork + Assignment + Test + Attendance

5	Design, implement, and discuss an analog/digital system with enhancements using microcontroller system from a given problem specification	Psychomotor	5	3	Classwork + Assignment + Attendance
6	Executing projects on Microcontroller applications	Psychomotor	5	3	Coursework + Assignment + attendance

Detailed Lecture Plan

Week NO	Lecture	Course Content To Be Covered	References
1	1 – 2	Discuss the Fundamentals of Transistors, oscillators and their applications	1. Experiments in Electronics Fundamental and Electric Circuits by David Buchla 2. Fundamentals of Digital Signal Processing 3. Microwave Power Amplifier Analysis and Design by Lawrence J. Kushner 4. Microprocessor
2 – 3	3 - 4	Analyze and synthesize amplifiers to have a working knowledge and their areas of applications	
4 – 5	5 – 7	Learn to design various types of amplifiers	
6 – 8	8 – 9	Learn basic software	

		applications in the simulation and design of amplifiers	Applications by Donald Stevenson and Keith Miller. Published by Wiley India 5. Programming Arduino: Getting Started with Sketches (second edition) by Simon Monk. 6. Fundamentals of Industrial Electronics: Edited by Bogdan M. Wilamowsky and J. David Irwin
9 – 10	10 – 12	Design, implement, and discuss an analog/digital system with enhancements using microcontroller system from a given problem specification	
11-12	13-14	Hand-On projects: Design and implementation of transmitter/receiver systems using hardware and software	
13–14	15 – 16	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

EEE-561: Mobile and Wireless Communications

Course Time table				
Course Title/Code: **Mobile and**	**Name of Lecturers:**	**Class Level:**	**Semester:**	**Duration:**

Wireless Communications (EEE 561)	**Professor Donatus Bassey**	**500 Level**	**First Semester**	**November 2022– March 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Wednesdays, 8 am – 10am** **Friday, 2pm –4 pm**		

Course Description/Objectives
This course provides a comprehensive overview and covers the fundamental technologies of typical wireless systems and networks for modern wireless communication systems. The emphasis is on the basic concepts that apply to all systems, rather than the details of any particular current system or standard. Building on the prior knowledge on digital communications, students develop further understanding on the challenges and opportunities brought by the wireless medium in designing current and future wireless communication systems and networks. The objectives of this course are to State various transmission and reception techniques used in different mobile communication systems, discuss evolution of mobile communication systems from 1G to 5G and beyond, and to know the importance of communication channel in performance of mobile communication system.
Course Outlines
1 Overview and evolution of wireless communication systems: Evolution of mobile radio communication 1G -5G and beyond, Motivation and Standardization bodies involved. 1G – 5G Architectures, salient features and technologies. 2 Multiple Access Schemes: Frequency Division Multiple Access (FDMA). Time Division Multiple Access – TDMA.

Code Division Multiple Access (CDMA). Orthogonal Frequency Division Multiple Access (OFDMA). Random Access Schemes.

3 Cellular Concepts: Frequency reuse. Cellular system design and Channel assignments. Interference, SIR and Capacity. Improving capacity in Cellular systems. Co channel interference reduction. Sectorization and cell splitting.

4 Mobile Radio Propagation: Transmission problems.

5 Free space path loss model. Three basic propagation mechanisms. Reflection. Diffraction. Scattering. 2 ray (plane earth or Ground reflection) model. Large scale fading – Shadowing.

6 Small scale fading – Multipath Fading. Rayleigh/Ricean Fading.

7 Fading effects due to multipath time delay Spread and Doppler spread.

8 Generalized path loss model - Path loss + multipath fading + Shadow fading. Mitigating Transmission problems. Practical link budget using path loss models.

9 Trunking and Grade of Service.

Recommended textbooks

1 Advances in Mobile and wireless communications: views of the 16th IST mobile and wireless communication summit by Frigyes, Istvajn, janos Bito, Pacter Bakki springer. 2008.

2 Wireless Communication circuit s and systems by Yichuang Sun. the institution of Engineering and Technology (IET)

S/N	CLO	Domain	Taxonomy Level	PEO	Assessment

1	Apply cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis to design cellular network with given quality of service constraints.	Cognitive	3	1	Classwork + Assignment + Attendance
2	Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.	Cognitive	5	3	Classwork + Assignment + Test + Attendance
3	Identify the challenges of radio propagation in the wireless channel and proffer solutions to them.	Cognitive	5	3	Classwork + Assignment + Test + Attendance

4	Describe and differentiate the generations of wireless standard for cellular networks from 1G to 5G and beyond, the motivations and standardization bodies involved.	Cognitive	3	1	Classwork + Assignment + Test + Attendance
5	Identify new trends in mobile/Wireless communication systems.	Cognitive	5	3	Classwork + Assignment + Attendance
6	A good analytical, Physical and intuitive understanding of the wireless channel	Cognitive	5	3	
7	Design and build a robust wireless system.	Cognitive	5	3	

Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Overview and evolution of wireless communication systems	1 Advances in Mobile and wireless communications: views of the 16th IST mobile and wireless communication summit by Frigyes, Istvajn, janos Bito, Pacter Bakki springer. 2008. 2 Wireless Communication circuit s and systems by Yichuang Sun. the institution of Engineering and Technology (IET)
2	3 – 4	Multiple Access Schemes: Frequency Division Multiple Access (FDMA). Time Division Multiple Access – TDMA. Code Division Multiple Access (CDMA). Orthogonal Frequency Division Multiple Access (OFDMA). Random Access Schemes	
3	5 – 6	Cellular Concepts: Frequency reuse. Cellular system design and Channel assignments. Interference, SIR and Capacity. Improving capacity in Cellular systems. Co channel interference reduction. Sectorization and cell splitting.	
4	7	Mobile Radio Propagation: Transmission problems.	
5	8-9	Free space path loss model. Three basic propagation mechanisms. Reflection. Diffraction. Scattering. 2 ray (plane earth or Ground reflection) model. Large scale	

		fading – Shadowing.	
6	10	6 Small scale fading – Multipath Fading. Rayleigh/Ricean Fading	
7	11-12	Fading effects due to multipath time delay Spread and Doppler spread.	
8	13	Generalized path loss model - Path loss + multipath fading + Shadow fading	
9 – 10	14	Mitigating Transmission problems. Practical link budget using path loss models	
11 – 12	15	Trunking and Grade of Service.	
13-14	16-18	Revision	
15	21-22	Test	
16	Final Semester Examination		

EEE 562 Microwaves and Satellite Communication

Course Time table				
Course Title/Code: **Microwave and**	**Name of Lecturers:** **Professor**	**Class Level:**	**Semester:**	**Duration:**

Satellite Communication (EEE 562)	**Donatus Bassey**	**500 Level**	**Second Semester**	**April, 2023 – July, 2023**
Credit Unit: 3	**Credit hours: 4**	**Class Timing: Monday 10am – 12pm** **Tuesday 10am – 12 pm**		

Course Description/Objectives
The objectives of this course are to explain microwave satellite communications, describe geosynchronous satellite communications, describe methods of TV transmission, discuss of wireless uplink and downlink, list the principles of the antenna-type used in satellite relay system, describe transponder and explain signal-to-noise ratio (S/N).
Course Outlines
3 Microwave components: Tees, circulators, directional couplers, attenuators, phase shifters, S-parameter analysis of microwave components. **4** Microwave sources: Klystron, microwave semiconductor devices, low noise microwave amplifiers, parametric amplifiers. **5** Physical media and link components: Microwave bands for satellite communication: Satellite microwave link calculations; Earth station components, parabolic dish antennas, G/T ratio. **6** Modulation Schemes used in satellite links: FDMA, TDMA and packet switched systems; spread spectrum techniques and CDMA systems, Satellite systems: Satellite classes; satellite

orbits: launching of a satellite and their monitoring.

7 Low orbit satellites for mobile communication.

Recommended textbooks

1 Wearable and neuronic antennas for medical and wireless applications by Arun Kumar, Manoj Gupter, Mahmoud A. Albreem, Dac-Binh Ha, Er. Mohit Kumar Sharma

Course Learning Outcomes (CLOs)

S/N	CLO	Domain	Taxonomy Level	PEOs	Assessment
1	Explain the significance of noise temperature in communication receivers	Cognitive	5	3	Classwork + Attendance
2	Define and explain what is meant by noise power.	Cognitive	2	2	Classwork + Assignment + Attendance
3	State Friis transmission formula	Cognitive	2	1	Classwork + Assignment + Attendance
4	Derive an expression for the carrier-to-	Cognitive	5	3	Classwork + Assignment

	noise ratio (C/N).				+ Test + Attendance
5	Explain the criterion for the delectability of a signal.	Cognitive	4	3	
6	Explain the different types of radar (monostatic and bistatic radar)	Cognitive	3	1	
7	Explain typical utilities of radar systems in civilian, military and scientific applications	Cognitive	3	2	
8	Sketch and explain TEM, TE and TM waves.	Cognitive	1	1	

DETAILED LECTURE PLAN			
Week No	**Lecture**	**Course Content to be Covered**	**References**
1	1 -2	Microwave components: Tees, circulators, directional	

		couplers, attenuators, phase shifters, S-parameter analysis of microwave components.	
2	2 -4	Microwave sources: Klystron, microwave semiconductor devices, low noise microwave amplifiers, parametric amplifiers.	1. Wearable and neuronic antennas for medical and wireless applications by Arun Kumar, Manoj Gupter, Mahmoud A. Albreem, Dac-Binh Ha, Er. Mohit Kumar Sharma .
3	5-7	Physical media and link components: Microwave bands for satellite communication: Satellite microwave link calculations; Earth station components, parabolic dish antennas, G/T ratio.	
4	8	Modulation Schemes used in satellite links: FDMA, TDMA monitoring	
5	9-10	Packet switched systems; spread spectrum techniques and CDMA systems, Satellite systems:	
6	11	Satellite classes; satellite orbits:	
7 – 9	12	Launching of a satellite and their	
10 – 11	13 – 15	Low orbit satellites for mobile communication.	
12 – 13	16 – 18	Test/continuous assessment	
15	21 – 22	Revision	

	Final Semester Examination

534: Computer Network and Distributed system

Course Time table				
Course Title/Code: Computer Network and distributed system /EEE 534	Name of Lecturers: Tony Miebi	Class Level: 500 Level	Semester: Second Semester	Duration: April, 2023 – July, 2023
Credit Unit: 3	Credit hours: 3	Class Timing: Wednesdays 8am – 10am		

Course Description:

The main aim of this course is to introduce the students to the principles, operation and the design heterogeneous networks, their inter-connections in practice, and how digital information flows from source to destination. The course will also study various protocols involved in successful transmission of packets from one end of the globe to the other end via the internet. This will naturally lead to the study of the Open System Interconnect also known as the OSI protocol layers. Towards this end, various network applications and their underlying protocols are discussed. Basics of socket programming enables students to understand the connection between Application Layer to Transport layer for reliable delivery of data. State-of-the-art congestion and flow control algorithms for flow of information over the internet are also taught. Existing routing algorithms concepts for information flow are covered along with the

medium access control protocols. Finally, how information moves step by step across various layers of the internet protocol stack to reach the final destination is summarized.

Course Outline

- Introduction and Motivation of networking and communication in IT applications
- Topologies and need for different topologies
- Circuit switching and packet switching
- Need for Protocols, Networking vocabulary
- Basic Overview and Functionalities of the TCP/IP Protocol stack
- Application layer protocols: HTTP, FTP, SMTP
- DNS, Basics of Socket Programming
- Transport Layer –Primitives, Multiplexing / De-Multiplexing, UDP
- Reliable Data Transfer (Selective Repeat, Go-Back-N), TCP – Connection, Flow control and congestion control algorithms Network layer functionalities, Routing Algorithms
- Link State (LS) and Distance Vector (DV) Routing Algorithms IP Addressing: IPV4 and IPV6 packet formats – comparison. Intra-autonomous system routing: RIP, OSPF, Inter-autonomous system routing: BGP
- Mobility at Network Layer, Data Link Layer Functionalities – Forwarding, Flow Control, Error Control, Medium Access Control (MAC) Protocols.
- Taxonomy, channel partitioning, random access, taking turn ,Random Access MAC protocols – Pure ALOHA, Slotted

ALOHA, CSMA, CSMA/CD, CSMA/CA, Address Resolution Protocol (ARP).

Recommended Textbook

3. Computer Networking: Top-Down Approach, 6th edition by Keith W. Ross, Addison - Wesley 2012

4. Computer Networking : Principles, Protocols and Practice, by Olivier Bonaventure, October 30, 2011

3. Local Area Network, by Gerd Keiser, 2002

4. Performance Analysis of the IEEE 802.11 Distributed Coordination Function, by G. Bianchi, IEEE Journal of Selected Areas in Communications, Vol. 18, No. 3, March 2000.

Course Learning Outcomes (CLOs)					
S/N	CLO	Domain	Taxonomy Level	PEO	Assessn
1	Understand fundamental concepts of Networks	Cognitive	2	1	Classwo Attenda
2	Have a good grasp of Networking protocols	Cognitive	2	2	Classwo Test + A
3	Able to distinguish between network types	Cognitive	3	2	Classwo Test + A
4	Is fully acquainted with OSI Model	Psychomotor	5	3	Classwo Test + A
5	Hands on practical Network SOCKET programming	Psychomotor	5	3	Classwo Attenda

Detailed Lecture Plan			
Week No	Lecture	Course Content to be Covered	References
1	1 – 2	Introduction, Motivation of networking and communication in IT applications, Topologies and need for different topologies, Circuit switching and packet switching. Need for Protocols, Networking parlance, TCP/IP Protocol Stack – Basic Overview and Functionalities	9. "Computer Networking: Top-Down Approach, 6th edition by Keith W. Ross, Addison - Wesley 2012 2. Computer Networking : Principles, Protocols and Practice, by Olivier Bonaventure, October 30, 2011 Local Area Network, by Gerd Keiser, 2002 4. Performance Analysis of the IEEE 802.11 Distributed Coordination Function, by G. Bianchi, IEEE Journal of Selected Areas in Communications,
2 – 3	3 - 4	Application layer protocols: HTTP, FTP, SMTP Application layer protocols, DNS, Basics of Socket Programming	
4 – 5	5 – 7	Transport Layer –Primitives, Multiplexing / De-multiplexing, UDP. Reliable Data Transfer (Selective Repeat, Go-Back-N), TCP – Connection, Segment Structure	
6 – 8	8 – 10	Flow control and congestion control algorithms – Week 8 – Network layer functionalities, Routing Algorithms – Link State (LS) and Distance Vector (DV) Routing Algorithms	
9 – 10	11 – 12	IP Addressing: IPV4 and IPV6 packet formats – comparison Weeks 10 & 11 – Intra-autonomous system routing: RIP, OSPF, Inter-autonomous system routing: BGP, Mobility at Network Layer	

11-12	13-14	Data Link Layer Functionalities – Forwarding, Flow Control, Error Control, Medium Access Control (MAC) Protocols: Taxonomy, channel Partitioning, random access, taking turn Weeks 13 & 14 - Random Access MAC protocols – Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, Address Resolution Protocol (ARP)	Vol. 18, No. 3, March 2000.
13–14	15 – 16	Revision	
15	15 – 16	Test	
16	Final Semester Examination		

APPENDIX A

ACADEMIC STAFF LIST

S/N	Names	RANK	**Qualification, dates obtained and specialization, membership of professional association of number of publications**
1	Dr. Priye Kenneth Ainah	Senior Lecturer /Ag. HOD	Ph.D (2018), MSc. (2010), B.Eng. (2006), COREN. R47,814
2	Prof. S.A. Adekola FAS,	Professor	Ph.D., (1975) M.Sc., (1972), B.Sc. (1968); FIET/ (FIEE), C. Eng., FAS, FA Eng., FASA., FNSE, Snr. Member IEEE; COREN: R.1771
5	Prof. Anthony O. Ibe	Professor	PhD (1984) (B.Eng (1979). COREN R.3497
4	Prof. Donatus Bassey	Professor	PhD, M.Sc, B.Sc COREN
5	Dr Ajabuego Goodleaf Oluchi	Senior Lecturer	PhD (2018),M.Eng (2000), B.Eng (1990). COREN R.12,611
5	Dr David Ebregbe	Senior Lecturer	PhD (2013), M.Sc. (2002), B.Eng. (1987) MNSE, MIEEE, MIET, COREN
6	Dr. Ayibapreye K. Benjamin	Senior Lecturer	PhD (2019), M.Sc (2010), B.Eng (2006). COREN

8	Dr Diton Geku	Lecturer I	B.Eng (2006) M.Sc (2013), PhD (2021)
9	Engr. John Tarilayon Afa	Lecturer I	M.Tech., (1988) COREN
10	Engr. Michael Tarerefa	Lecturer II	M.Sc (2014),B.Eng (2008)
11	Engr. Godday Biowei	Lecturer II	MSc. (2010), B.Eng. (2007) COREN
12	Gabriel Moses	Lecturer II	M.Sc (2002) B.Tech (1990)
13	Engr. Fawei Jenny	Lecturer II	MSc. (2014), B.Eng. (2008)
14	Engr. Tebe Ojunkonsin	Lecturer II	B.Tech (2006), M.Sc (2009)
15	Engr. James Sokari	Lecturer II	B.Eng (2006), M.Eng (2014)
16	Miebi Tony Tunyei	Assistant Lecturer	MSc. (2014), B.Eng. (2008)
19	Danfebo Frankline Ayebagbalinyo	Graduate Assistant	B. Eng (Electrical & Electronic Engineering)
20	Oyindipre Bioko	Graduate Assistant	B.Eng (Electrical & Electronic Engineering)

LIST OF FACULTY ACADEMIC STAFF SERVICING THE DEPARTMENT

S/N	Names	RANK	Qualification, dates obtained and specialization, membership of professional association of number of publications
1	Prof. Okpala Alexander Nwachukwu	Professor	PhD (2003), M.Sc (1997), B.Eng (1991). COREN-R7735
2	Prof. Solomon t. Orumu	Professor	Ph.D– 2003, M.Tech –1998 , B.Tech- 1995 MNSE, MNICE, COREN.
3	Dr. Reward K. Douglas	Senior Lecturer	B.Eng (2006) M.Sc, PhD (2018). COREN Registered
4	Dr. Tolumoye John Ajoko	Senior Lecturer	PhD (2022), M.Sc (2009), B.Eng (2007) COREN.
5	Dr E. A. Kiridi	Senior Lecturer	Ph.D (2013), M.Tech (2006), B.Tech (1998). COREN
6	Dr. Philip O. Olisa	Senior Lecturer	Ph.D (2016) MSc (2001), B.Eng (1997) CORREN Registered

LIST OF TECHNICAL STAFF

S/N	Name	Rank	Qualifications, Dates Obtained Membership of Professional Association
1	Teknikio Meni Joseph	Chief Technologist	HND (2003), B.Sc (2007)
2	Agala Anikedigiri George	Technologist II	ND (2006), HND (2009)
3	Ozori Agorowei	Assist. Chief Technical Officer	OND (1997), HND (2002)
4	Teri Longlife Ikiyotiyemoh	Chief Technologist	HND (2006), OND (2002)
5	Omun P. Inaye	Principal Technologist	B.Tech (2006)
6	Imiebolamie Mathew M.	Chief Technologist	B.Tech (2006)
7	Zikena Asinga Douye	Principal Technologist	B.Eng (2009), MNSE