DEPARTMENT OF COMMUNICATIONS ENGINEERING

FACULTY OF ENGINEERING
AHMADU BELLO UNIVERSITY, ZARIA

B.ENG (COMMUNICATIONS ENGINEERING) CURRICULUM

2018

EXISTING CURRICULA

100 LEVEL

Students must offer a minimum total of **37 credit units** at 100 Level comprising the following: **19 credit units** of core and cognate courses in the First Semester and **18 credit units** of core and cognate courses in the Second Semester

FIRST SEMESTER 100L COURSES

S/N	Code	Title	Status	CU	Prerequisites
1	CHEM101	Introductory General Chemistry	Core	2	
2	CHEM121	Inorganic Chemistry	Core	2	
3	CHEM161	Chemistry Practical 1	Core	1	
4	PHYS111	Mechanics	Core	2	
5	PHYS131	Heat and Properties of Matter	Core	2	
6	PHYS161	Physics Practical 1	Core	1	
7	MATH101	Elementary Set Theory	Core	2	
8	MATH103	Trigonometry and Co-ordinate Geometry	Core	2	
9	MATH105	Differential and Integral Calculus	Core	2	
10	GENS101	Nationalism	General	1	
11	GENS103	English and Communication Skills	General	2	
	Total			19	

SECOND SEMESTER 100L COURSES

S/N	Code	Title	Status	CU	Prerequisites
1	CHEM112	Introductory Physical Chemistry	Core	2	
2	CHEM162	Chemistry Practical II	Core	1	
3	PHYS122	Electricity, Magnetism and Modern Physics.	Core	2	
4	PHYS124	Geometrical and Wave Optics	Core	1	
5	PHYS162	Physics Practical II	Core	1	
6	MATH102	Algebra	Core	2	
7	MATH104	Conic Sections and Applications0 of Calculus	Core	2	
8	MATH106	Vectors	Core	2	
9	STAT102	Introductory Statistics	Core	2	
10	COSC102	Programming in Basic	Core	2	
11	ENGG102	Introduction to Engineering	Core	1	
	Total			18	

S/N	Code	Title	Status	CU	Prerequisites
1	GENS102	Environmental Health	Elective	1	
2	GENS104	History and Philosophy of Science	Elective	1	

200 LEVEL

Students must offer a minimum total of **36 credit units** at 200 Level comprising the following: **17 credit units** of core and cognate courses in the First Semester and **19 credit units** of core and cognate courses in the Second Semester

FIRST SEMESTER 200L COURSES

S/N	Code	Title	Status	CU	Prerequisite
1	EEEN201	Electric Field and Circuit Theory	Core	2	PHYS122
2	EEEN203	Machines, Power and Installations	Core	2	PHYS122
3	CVEN201	Theory of Structures	Core	2	
4	MEEN201	Engineering Graphics	Core	2	
5	MMEN201	Material Science	Core	2	
6	MATH241	Calculus I	Core	3	MATH105
7	MATH243	Algebra I	Core	2	MATH102
8	WREN201	Fluid Mechanics	Core	2	
	Total			17	

SECOND SEMESTER 200L COURSES

S/N	Code	Title	Status	CU	Prerequisite
1	EEEN202	Electronics, Measurement and Transducers	Core	2	PHYS122
2	CHEN202	Introduction to Management	Core	1	
3	MEEN202	Engineering Drawing	Core	3	
4	MEEN204	Strength of Materials	Core	2	
5	MEEN206	Dynamics of Machines	Core	2	
6	MEEN208	Basic Thermodynamics	Core	2	
7	MATH242	Calculus II	Core	2	MATH105
8	MATH244	Algebra II	Core	3	MATH102
9	GENS202	Entrepreneurship and Innovation	General	2	
			Total	19	

300 LEVEL

Students must offer a minimum total of **41 credit units** at 300 Level comprising the following: **21 credit units** of core and cognate courses in the First Semester and **16 credit units** of core and cognate courses in the Second Semester, a minimum of **3 credit unit**s of restricted electives and **1 credit unit** of unrestricted elective

FIRST SEMESTER 300L COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	EEEN301	Circuit Theory and Systems I	2	EEEN201	Core
2	EEEN303	EM Fields and Waves	2	EEEN201	Core
3	EEEN309	Electrical Machines	2	EEEN203	Core
4	EEEN311	Laboratory Practical and Project I	2	-	Core
5	COEN301	Introduction to Computer Systems	2	-	Core
6	COEN303	Control Engineering I	2	-	Core
7	CMEN307	Digital Electronics	2	EEEN202	Core
8	MATH341	Diff. Equations and Transforms	3	MATH241	Cognate
9	STAT343	Statistics	2	STAT102	Cognate
10	GENS301	Business Creation and Growth	2	-	Core
		Total	**21**		

SECOND SEMESTER 300L COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	EEEN302	Circuit Theory and Systems II	2	EEEN201	Core
2	EEEN304	Power Engineering I	2	EEEN203	Core
3	EEEN306	Power Electronics I	2	EEEN202	Core
4	EEEN308	Measurements and Instrumentation	2	EEEN202	Core
5	EEEN314	Laboratory Practical and Project II	2	-	Core
6	CMEN308	Physical Electronics	2	EEEN202	Core
7	CMEN310	Electronics Engineering I	2	EEEN202	Core
8	CMEN312	Telecommunication Principles	2	EEEN202	Core
		Total	**16**		

RESTRICTED ELECTIVE COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	EEEN318	Technical Writing and Presentation	1	-	Restricted
2	COSC344	Programming in Java	2	-	Restricted
3	QTYS309	Development Economics	2	-	Restricted

UNRESTRICTED ELECTIVES: Electives can be offered from any one of the following Faculties: Engineering, Environmental Design, Science, Arts, Social Sciences, Education and Administration.

400 LEVEL

Students must offer a minimum total of 26 credit units at 400 Level comprising the following: **20 credit units** of core and cognate courses in the First Semester and **6 credit units** of SIWES in the Second Semester and Long Vacation.

FIRST SEMESTER 400L COURSES

S/N	CODE	Title	Status	CU	Prerequisite
1	CMEN401	Data Communication	Core	2	CMEN312
2	CMEN405	Digital Electronics II	Core	2	CMEN307
3	CMEN411	Communication Laboratory Practical	Core	2	EEEN311
4	COEN401	Microprocessor and Microcontroller Applications	Core	2	-
5	COEN403	Programming in C^{++}	Core	2	-
6	COEN405	Network Technology	Core	2	COEN301
7	COEN407	Control Engineering II	Core	2	COEN303
8	QTYS421	Law For Engineers	Cognate	1	
9	MATH441	Complex Analysis	Cognate	2	MATH341
10	MATH443	Numerical Analysis	Cognate	3	
			Total	20	

SIWES: 22 Weeks (Second Semester and Long Vacation (6 Credit Units)

500 LEVEL

Students must offer a minimum total of 36 credit units at 500 Level comprising the following: **17 credit units** of core courses in the First Semester and **17 credit units** of core courses in the Second Semester, a minimum of **2 credit unit**s of restricted electives and **0 credit unit** of unrestricted elective.

FIRST SEMESTER 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	EEEN503	Advanced EM Fields and Waves	2	EEEN303	Core
2	EEEN509	Engineering Management and Decision Making	2	-	Core
3	EEEN511	Reliability and Maintainability	2	-	Core
4	CMEN501	Integrated Circuits and Systems Design	2	CMEN405	Core
5	CMEN503	Telecommunication Networks I	2	CMEN401	Core
6	CMEN505	Communication Theory and Systems	2	CMEN401	Core
7	CMEN517	Digital Signal Processing	2	EEEN302	Core
8	CMEN599	Final Year Project	3	-	Core
		Total	17		

SECOND SEMESTER 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	CMEN502	Radio Communication	2	CMEN401	Core
2	CMEN504	Telecommunications Networks II	2	CMEN312	Core
3	CMEN506	Optical Fibre Communication	2	CMEN401	Core
4	CMEN508	Satellite Communication	2	CCEN401	Core
5	CMEN510	Communications Systems Policy and Planning	2	-	Core
6	CMEN512	Digital Switching Systems	2	CMEN405	Core
7	CMEN518	Advanced Signal Processing	2	-	Core
8	CMEN599	Final Year Project	3	-	Core
		Total	17	-	

RESTRICTED ELECTIVE 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	EEEN501	Advanced Circuit Theory	2	EEEN302	Restricted
2	COEN504	Web-Based Design and Applications	2	-	Restricted
3	COEN506	Computer System Architecture	2	COEN301	Restricted
4	COEN510	Network Security and Cryptography	2	COEN413	Restricted
5	CMEN514	Tele-Traffic Analysis	2	CMEN312	Restricted
6	CMEN516	Communications Power Systems	2	EEEN304	Restricted

SUMMARY TABLE

S/N	Level	Total CU
1	100L	37
2	200L	36
3	300L	41
4	400L	26
5	500L	36
TOTAL		176

ENTRY LEVEL	**GRADUATION CU**
100L	**176**
200L (DE)	**142**
300L (SPECIAL)	**109**

PROPOSED CURRICULA (2018/2019)

100 LEVEL

Students must offer a minimum total of **40 credit units** at 100 Level comprising the following: **19 credit units** of core and cognate courses in the First Semester and **21 credit units** of core and cognate courses in the Second Semester

FIRST SEMESTER 100L COURSES

S/N	Code	Title	Status	CU	Prerequisites
1	CHEM101	Introductory General Chemistry	Core	2	
2	CHEM121	Inorganic Chemistry	Core	2	
3	CHEM161	Chemistry Practical 1	Core	1	
4	PHYS111	Mechanics	Core	2	
5	PHYS131	Heat and Properties of Matter	Core	2	
6	PHYS161	Physics Practical 1	Core	1	
7	MATH101	Elementary Set Theory	Core	2	
8	MATH103	Trigonometry and Co-ordinate Geometry	Core	2	
9	MATH105	Differential and Integral Calculus	Core	2	
10	GENS101	Nationalism	General	1	
11	GENS103	English and Communication Skills	General	2	
	Total			19	

SECOND SEMESTER 100L COURSES

S/N	Code	Title	Status	CU	Prerequisites
1	CHEM112	Introductory Physical Chemistry	Core	2	
2	CHEM162	Chemistry Practical II	Core	1	
3	PHYS122	Electricity, Magnetism and Modern Physics.	Core	2	
4	PHYS124	Geometrical and Wave Optics	Core	1	
5	PHYS162	Physics Practical II	Core	1	
6	MATH102	Algebra	Core	2	
7	MATH104	Conic Sections and Applications0 of Calculus	Core	2	
8	MATH106	Vectors	Core	2	
9	STAT102	Introductory Statistics	Core	2	
10	COSC102	Programming in Basic	Core	2	
11	ENGG102	Introduction to Engineering	Core	1	
12	GENS104	History and Philosophy of Science	core	1	
13	CMEN 102	Introduction to Electronic Communications I	core	2	
	Total			21	

S/N	Code	Title	Status	CU	Prerequisites
1	GENS102	Environmental Health	Elective	1	

200 LEVEL

Students must offer a minimum total of **38 credit units** at 200 Level comprising the following: **19 credit units** of core and cognate courses in the First Semester and **19 credit units** of core and cognate courses in the Second Semester

FIRST SEMESTER 200L COURSES

S/N	Code	Title	Status	CU	Prerequisite
1	EEEN201	Electric Field and Circuit Theory	Core	2	PHYS122
2	EEEN203	Machines, Power and Installations	Core	2	PHYS122
3	CVEN201	Theory of Structures	Core	2	
4	MEEN201	Engineering Graphics	Core	2	
5	MMEN201	Material Science	Core	2	
6	MATH241	Calculus I	Core	3	MATH105
7	MATH243	Algebra I	Core	2	MATH102
8	WREN201	Fluid Mechanics	Core	2	
9	CMEN 201	Introduction to Electronic Communications II	Core	2	
	Total			19	

SECOND SEMESTER 200L COURSES

S/N	Code	Title	Status	CU	Prerequisite
1	CMEN202	Electronics, Measurement and Transducers	Core	2	PHYS122
2	CHEN202	Introduction to Management	Core	1	
3	MEEN202	Engineering Drawing	Core	3	
4	MEEN204	Strength of Materials	Core	2	
5	MEEN206	Dynamics of Machines	Core	2	
6	MEEN208	Basic Thermodynamics	Core	2	
7	MATH242	Calculus II	Core	2	MATH105
8	MATH244	Algebra II	Core	3	MATH102
9	GENS202	Entrepreneurship and Innovation	General	2	
			Total	19	

300 LEVEL

Students must offer a minimum total of **41 credit units** at 300 Level comprising the following: **22 credit units** of core and cognate courses in the First Semester and **14 credit units** of core and cognate courses in the Second Semester, a minimum of **3 credit unit**s of restricted electives.

FIRST SEMESTER 300L COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	CMEN301	Circuit Theory and Systems I	2	EEEN201	Core
2	CMEN303	EM Fields and Waves	3	EEEN201	Core
3	CMEN307	Digital Electronics	2	EEEN202	Core
4	CMEN311	Laboratory Practical and Project I	2	-	Core
5	COEN301	Introduction to Computer Systems	2	-	Core
6	COEN303	Control Engineering I	2	-	Core
7	EEEN309	Electrical Machines	2	EEEN203	Core
8	MATH341	Diff. Equations and Transforms	3	MATH241	Cognate
9	STAT343	Statistics	2	STAT102	Cognate
10	GENS301	Business Creation and Growth	2	-	Core
		Total	**22**		

SECOND SEMESTER 300L COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	CMEN302	Circuit Theory and Systems II	2	EEEN201	Core
2	CMEN306	Fundamentals of Power Electronics	2	EEEN202	Core
3	CMEN308	Measurements and Instrumentation	2	EEEN202	Core
4	CMEN314	Laboratory Practical and Project II	2	-	Core
5	CMEN308	Physical Electronics	2	EEEN202	Core
6	CMEN310	Electronics Engineering I	2	EEEN202	Core
7	CMEN312	Telecommunication Principles	2	EEEN202	Core
8	EEEN304	Power Engineering I	2	EEEN203	Core
		Total	16		

RESTRICTED ELECTIVE COURSES

S/N	CODE	TITLE	CU	Prerequisite	Status
1	CMEN318	Technical Writing and Presentation	1	-	Restricted
2	COSC344	Programming in Java	2	-	Restricted
3	QTYS309	Development Economics	2	-	Restricted

UNRESTRICTED ELECTIVES: Electives can be offered from any one of the following Faculties: Engineering, Environmental Design, Science, Arts, Social Sciences, Education and Administration.

400 LEVEL

Students must offer a minimum total of 26 credit units at 400 Level comprising the following: **20 credit units** of core and cognate courses in the First Semester and **6 credit units** of SIWES in the Second Semester and Long Vacation.

FIRST SEMESTER 400L COURSES

S/N	CODE	Title	Status	CU	Prerequisite
1	CMEN401	Data Communication	Core	2	CMEN312
2	CMEN405	Digital Electronics II	Core	2	CMEN307
3	CMEN411	Communication Laboratory Practical	Core	2	EEEN311
4	COEN401	Microprocessor and Microcontroller Applications	Core	2	-
5	COEN403	Programming in C^{++}	Core	2	-
6	COEN405	Network Technology	Core	2	COEN301
7	COEN407	Control Engineering II	Core	2	COEN303
8	QTYS421	Law For Engineers	Cognate	1	
9	MATH441	Complex Analysis	Cognate	2	MATH341
10	MATH443	Numerical Analysis	Cognate	3	
			Total	20	

SIWES: 22 Weeks (Second Semester and Long Vacation (6 Credit Units)

500 LEVEL

Students must offer a minimum total of 35 credit units at 500 Level comprising the following: **17 credit units** of core courses in the First Semester and **16 credit units** of core courses in the Second Semester, a minimum of **2 credit unit**s of restricted electives.

FIRST SEMESTER 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	CMEN501	Integrated Circuits and Systems Design	2	CMEN405	Core
2	CMEN503	Telecommunications Networks I	2	CMEN401	Core
3	CMEN505	Information Theory and Source Coding	2	CMEN401	Core
4	CMEN507	Electronics Engineering II	2	CMEN308	Core
5	CMEN509	Engineering Management and Decision Making	2	-	Core
6	CMEN511	Reliability and Maintainability	2	-	Core
7	CMEN517	Digital Signal Processing	2	CMEN302	Core
8	CMEN599	Final Year Project	3	-	Core
		Total	17		

SECOND SEMESTER 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	CMEN502	Radio Communication	2	CMEN401	Core
2	CMEN504	Telecommunications Networks II	3	CMEN312	Core
3	CMEN506	Optical Fibre Communication	2	CMEN401	Core
4	CMEN508	Satellite Communication	2	CMEN401	Core
5	CMEN510	Wireless and Mobile Communications	2	-	Core
6	CMEN514	Teletraffic Engineering	2	CMEN312	
8	CMEN599	Final Year Project	3	-	Core
		Total	16	-	

RESTRICTED ELECTIVE 500L COURSES

S/N	CODE	Title	CU	Prerequisite	status
1	CMEN512	Digital Switching Systems	2	CMEN405	Restricted
2	CMEN516	Communication Power Systems	2	CMEN304	Restricted
3	EEEN501	Advanced Circuit Theory	2	EEEN302	Restricted
4	COEN504	Web-Based Design and Applications	2	-	Restricted
5	COEN506	Computer System Architecture	2	COEN301	Restricted
6	COEN510	Network Security and Cryptography	2	COEN413	Restricted

CMEN: Communication Engineering
COEN: Computer Engineering
EEEN: Electrical Engineering

SUMMARY TABLE (PROPOSED)

S/N	Level	Total CU
1	100L	40
2	200L	38
3	300L	40
4	400L	26
5	500L	35
TOTAL		180

ENTRY LEVEL	**GRADUATION CU**
100L	**180**
200L (DE)	**140**
300L (SPECIAL)	**108**

COURSES AND SYLLABUS
100 LEVEL

CMEN 102: INTRODUCTION TO ELECTRONIC COMMUNICATIONS (I) (2 Credit Units) CORE

LEARNING OBJECTIVES

1. To define engineering and the impact of electronic engineering on modern society
2. To identify basic electronic components
3. To understand standard symbols used for basic electronic components
4. To understand the SI units for basic electrical quantities.
5. To identify the basic building blocks of linear and digital integrated circuits
6. To identify and understand the functions of basic electronic measuring equipment
7. To identify and understand the impacts of electronic communications on modern society

COURSE OUTLINE

MODULE I: General Perspectives of Electronic Engineering
State the meanings of: engineering, electrical engineering, electronic engineering, electronic communication/telecommunications. Describe the relationship between electronics and other branches of electrical engineering.

MODULE II: Services Provided by Electronic Communications
Explain the impact of electronic engineering on modern society**. Broadcasting**: Radio. Television. Telephony, e-commerce, e-education, e-banking, e-medical, e-mail. The Internet, multimedia services, etc

MODULE III: Basic Electrical Components Identification
Basic components identification: Resistor, Capacitor, Inductor, Transistor, Diode, Basic logic gates; AND, NAND, NOT, OR, NOR, Exclusive-OR and their standard symbols of these components. Functions of these components in electrical circuit. State the units of measure of Resistor, Capacitor, Inductor. Using colour coding to determine the values of resistors.

MODULE IV: Basic Electricity (D.C) -I
Define electric circuit. State the basic concept of a flow of electric current. State the effects of an electric current: heating, chemical, magnetic. Distinguish between electrical conductors and insulators. State the units of current (Ampere), potential difference (Volt), resistance (Ohm). Define the coulomb, Ampere, Volt, and Ohm.

MODULE V: Basic Electricity (D.C) -II
State Ohm's law and use the law to solve simple electrical circuit problems; resistors in series and parallel. Capacitors in series and parallel. Identify the formula for power in a resistive electrical circuit (power = voltage x current). Show that power can also be calculated from I^2 R and from V^2/R . Define the Watt as the SI unit of power. Identify the formula for energy in resistive electrical circuit (energy = power x time)

MODULE VI: A.C Circuits
Describe the relationship between peak, peak-to-peak, average and root-mean-squared (r.m.s) values of sine waves. Explain why r.m.s values are important. Calculate the r.m.s value given the peak, peak-to-peak or average values and vice versa.

MODULE VII: Signal Waveforms
Explain how sound waves are converted into electrical signals by means of a **transducer.**
Explain how electrical signals are converted into sound waves by means of a **transducer.**
Amplitude, frequency, phase, wave-shape, complex (consisting of a combination of sinusoidal waveforms). Explain the relationship between velocity (v), frequency (f) and wavelength (λ). Describe the factors that affect signals: gain (amplification), loss (attenuation), distortion (shape), frequency, interference, noise

MODULE VIII: Digital Integrated Circuits
State that linear integrated circuits are available for a variety of applications such as: amplifiers, oscillators, comparators, etc. State that digital integrated circuits are available to provide a number of logical functions such as: **AND, OR, NOT, NAND, NOR, Exclusive-OR**

MODULE IX: Basic Measuring Equipment

Describe the principle and use of the following measuring equipment: Ohmeter, Voltmeter, Ammeter, Digital multimeter, Oscilloscope, Spectrum Analyser. Explain the purpose of calibration as a preparatory step before measurements are taken

LEARNING OUTCOMES

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

1. Understand the meaning of electronic engineering and its relationship with electronic communications.
2. Describe the various services provided by electronics and electronic communications
3. Describe the various devices provided by electronics and their applications
4. Identify basic electronic components
5. Identify integrated Circuits
6. Explain the principles and applications of basic measuring equipment
7. Explain the concept of signal

GRADING

Method	**Weight**
Report/Presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

200 LEVEL COURSES
200 LEVEL FIRST SEMESTER

CMEN 201: INTRODUCTION TO ELECTRONIC COMMUNICATIONS (II)
(2 Credit Units) CORE

LEARNING OBJECTIVES

8. To describe the functions of the main building blocks of generic analogue and digital telecommunications systems
9. To describe the main types of impairments in telecommunications systems and their effects on performance, capacity and bandwidth.
10. To describe the main types of telecommunications transmission media and their limitations
11. To describe the key telecommunications networks/services.
12. To describe radio frequency bands and their applications.
13. To describe the main types of semiconductor diodes and their applications
14. To describe half wave and full wave rectification and explain hy they are used in power supplies
15. To describe transistor action and explain the three method of connecting a transistor in a circuit.
16. To describe solid- state switching circuits such as multi-vibrators. Distinguish between electro-mechanical switches and solid-state switches
17. To describe some key waveform generators

COURSE OUTLINE

MODULE I: Basic Telecommunications Systems
Explain the difference between communications and telecommunications. Describe, using simple block diagrams; analogue and digital communications systems. Explain the advantages and disadvantages of digital communications system. Describe radio frequency bands and their applications

MODULE II: Telecommunications Networks and Services
Describe, using simple block diagrams, the following types of telecommunications services: Telephone network, intelligent network, data communications network, cellular mobile network, internetwork (i.e., Internet), satellite communications network. Radio and TV broadcasting. Explain the meaning of convergence in telecommunications

MODULE III: Types of Impairments in Telecommunications Systems
Describe in simple language, the following types of impairments that occur in telecommunications systems: attenuation, interference, distortion, fading. Explain the effects of these impairments on system capacity, bandwidth and quality of service.

MODULE IV: Types of Telecommunications Transmission Media
Explain the difference between guided and unguided transmission media. LIST the types of guided and unguided transmission media. Describe their performance and limitations in terms of coverage distance, losses, and frequency of operation.

MODULE V: Semiconductor Diodes
List and describe main types of semiconductor diodes and their applications. Describe, using a simple schematic circuit diagram, for measuring the current/voltage characteristics of a semiconductor diode. Dscribe the following specia-purpose diodes: Light Emitting Diode (LED), photo diode, varactor diode

MODULE VI: Power Supplies:
Explain the meaning of **rectification** in the context of operation of electronic and radio equipment. Describe, using simple schematic diagrams, the following rectifier circuits: (i) halfwave rectifier; (ii) full wave rectifier. Describe the relationship between peak, peak-to-peak, average and root-mean-squared (r.m.s) values of sine waves. Explain why r.m.s values are important. Calculate the r.m.s value given the peak, peak-to-peak or average values and vice versa.

MODULE VII: Transistors
Describe, in simple language, the action of a transistor. Explain the following basic ways of connecting a transistor in a circuit: (i) common-base connection; (ii) common-emitter connection; (iii) common-collector connection.

MODULE VIII: Waveform Generators
Describe a simple L-C oscillator circuit. Explain how frequency stability is achieved

MODULE VIII: Solid-State Switching Circuits
Compare and contrast between mechanical switch, electro-mechanical switch and electronic switch. Describe, in simple language, the multi-vibrator action. LIST the main types of multi-vibrators.

LEARNING OUTCOMES

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

8. Understand and describe and explain all the elements in modules I to VIII.

Grading

1. Continuous assessment: Assignments, Reports/Presentation, Written test (40%)
2. Semester Examination (60%)

200 LEVEL SECOND SEMESTER

CMEN202: ELECTRONICS, MEASUREMENTS AND TRANSDUCERS
(2 Credit Units)

OBJECTIVES:

1. To understand the types of materials in terms of electrical conductivity
2. To understand how electronics components are designed (diodes, LED, BJT and FET)
3. To understand how electronics components are used in design of electronic circuits (rectifiers, amplifiers, oscillators switches)
4. To be able to carry out laboratory practicals using electronic components
5. To understand basics of measuring instruments (Ammeter, Voltmeter, Wattmeter)
6. To understand the fundamentals of transducers and their applications

MODULE I: ELECTRONIC MATERIALS

Electronics; charge particles and atomic structure of matter; energy levels in an atom; energy band theory of solids (conductors, insulators, semi-conductors); conductivity in solids; conductivity in semiconductors (intrinsic; extrinsic); mass-action law and carrier concentrations; transportation of electric current; drift in an electric field and diffusion due to temperature effect.

MODULE II: DIODES (PN JUNCTION) DEVICES

PN junction diode and its formation; forward-biased; reverse-biased; diode current and voltage relationship; operation of diode; avalanche and Zener breakdown; applications of diodes (rectification; voltage doubling; clipper (limiter); clamper; light emitting diode; two color LED emitter; applications of LEDS; photodiode; Zener diode)

MODULE III: BIPOLAR JUNCTION TRANSISTORS

Bipolar Junction Transistor: Transistor Circuit; Common-Emitter (CE); Configuration; Common-Base (CB) Configuration; Common-Collector (CC) Configuration. Transistor Operation Parameters, Applications of Transistor: Amplifier; Oscillator; Switch

MODULE IV: JUNCTION FIELD-EFFECT TRANSISTOR (JFET)

Junction FET (JFET); N-Channel JFET Operation; P-Channel JFET Operation; Transfer Characteristics of JFET; JFET Specification Sheet

MODULE V: MEASUREMENTS & TRANSDUCERS

General principle of measuring instruments. Torques and spring relationship. Types of instrument: Ammeters, Voltmeters, Wattmeters, Watt-hour-meters.

Transducers and Bridge measurements: Measurement of resistance, measurement of frequency. Electrical pressure transducers. Displacement transducers. Electrical temperature transducers. Measurement of speed by electrical means.

LABORATORY PRACTICALS

1. Experiment on half-wave and full-wave rectifier circuits
2. Simple transistor amplifier circuit
3. Simple audio amplifier circuit

Learning Outcomes

Upon successful completion of the course, students should:

1. Know the different types of materials in terms of electrical conductivity
2. Know how electronics components are designed (diodes, LED, BJT and FET)
3. Know how electronics components are used in design of electronic circuits (rectifiers, amplifiers, oscillators switches)
4. Carry out laboratory practical using electronic components
5. Know basics of measuring instruments (Ammeter, Voltmeter, Wattmeter)
6. Know the fundamentals of transducers and their applications

GRADING

Method	Weight
Report/Presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

300 LEVELS
FIRST SEMESTER

CMEN 303: ELECTROMAGNETIC FIELDS AND WAVES (3 CREDIT UNITS)
Aim: Introduce the fundamental properties of electromagnetic fields in an engineering context.

OBJECTIVES:

1. Students shall understand the concept of vector analysis to facilitate the analysis of Electric and Magnetic fields and also use vector calculus and other mathematics to describe electromagnetic phenomena.
2. Students shall be able to state and explain the laws and principles of electric, magnetic, and electromagnetic fields.
3. Students will be introduced to some fundamental concept of electricity and magnetism to form a bridge between circuit theory to the transmission lines, waves and wireless systems, in order to solve problems in electrostatic, magnetostatic, and electromagnetic fields, that describe the principles of operation of several electrical, magnetic, and electromagnetic devices.
4. Students will be introduced to some areas of applications of electromagnetic fields and waves.
5. Understand the principles and applications of time - varying electro-magnetic Fields

MODULE I: REVIEW OF VECTORS

Review of Vector Laws and Vector Analysis, Use of vector algebra in Cartesian, Cylindrical, and Spherical coordinate systems. Vectors Transformation between the three primary coordinate systems. Gradient of a scalar function and the divergence and curl of a vector function in any of the three primary coordinate systems. Application of the divergence theorem and Stokes's theorem.

MODULE II: REVIEW OF EM LAWS

Gauss law. Ampere's law and Faraday's law;
Review of EM laws in static and dynamic states. Quasi-stationary magnetic fields.
Electric and magnetic problems and solutions.
Derive Maxwell's equations in both differential and integral forms. Apply EM laws and Maxwell's equation to solve wave equations in free space and in lossless medium.
Explain practical applications of these laws

MODULE III: UNIFORM EM PLANE WAVES:

Magnetic fields in and around current carrying conductors; Conduction and displacement currents; Derivation of Maxwell's equation in curl form from Faraday's and Ampere's laws; Time varying electric and magnetic fields in free space; The wave equation; Plane waves in vacuum, dielectric conducting and lossy media; Skin effect; Polarization of waves; Poynting's vector and energy propagation in free space; Discuss Electric fields of two-electrode configurations. Explain Field distribution in air-gaps Boundary conditions; Plane waves in unbounded dielectric media; Reflection and transmission of plane waves. Eddy currents and braking power.

MODULE IV: EM RADIATING SYSTEMS

Antennae: isotropic antenna, elementary dipole near the far fields; Antenna parameters; Half-wave antenna; Practical antenna e.g. loop, horn and parabolic.

MODULE V: WAVE-GUIDES

Wave-guides: E and H wave modes. Field patterns in rectangular wave-guides. Propagation characteristics. Modes in Rectangular Waveguides, energy flow and attenuation
Explain Resonant cavities and Optical Fibers**:** Field at the surface and within a conductor, cylindrical cavities and waveguides

MODULE VI:

Schwartz problems and Christoffel transformation.
Numerical analysis and Simulation.

Learning Outcomes

Students that successfully complete this course should be able to:

1. Understand how vector analysis can be used to facilitate the analysis of Electric and Magnetic fields. OR Use vector calculus and other mathematics to describe electromagnetic phenomena.
2. Explain basic laws that govern Electromagnetic fields and waves.

3. Apply the laws and principles of electricity and magnetism in solving practical problems in electromagnetic fields.
4. Explain some areas of applications of electromagnetic fields and waves.
5. Understand the principles and applications of time - varying electro-magnetic Fields and be familiar with Maxwell's equations
6. Understand Poynting's theorem and the conservation energy and momentum
7. Understand the principles of propagation of waves in a guided media
8. Understand Schwartz and Christoffel transformation and expose students to some EM simulations software
9. To understand a typical application of Electromagnetic phenomena as in Eddy currents and braking power system.

PRACTICAL

1. Electric fields Experiments-The Cenco Overbeck Apparatus
2. Map Electric fields and equi-potentials for three electrodes

3. GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%

CMEN 307: DIGITAL COMMUNICATIONS (3 CREDIT UNITS)

OBJECTIVES:

The primary goal of the course is to provide students with an understanding of the fundamentals of digital signalling, information theory and coding, digital transmission, and reception. The goal is to equip the students with the basic knowledge for designing, analysing, comparing, and managing digital communication systems.

MODULE I: INTRODUCTION

This module covers the motivation for the introduction of digital communication systems, comparison between analog and digital communication systems, an overview of a digital communication system and channel characteristics.

MODULE II: COMMUNICATION SIGNALS AND SYSTEMS CHARACTERIZATION

This module covers the mathematical representation of bandpass signals and systems, mathematical representation of bandpass noise, and vector space concepts for signal representation.

MODULE III: DIGITAL MODULATION AND TRANSMISSION SYSTEM MODEL

This module covers digital modulation theory for an additive white Gaussian noise (AWGN) channel, binary modulation, *M*-ary baseband and bandpass modulation/demodulations, and detection methods in AWGN channel. It also covers bit vs. symbol error probabilities, bit error rate (BER) graph reading and relations to symbol error rate (SER).

MODULE IV: BASIC INFORMATION AND CODING THEOREMS

This module covers introduction to information theory and coding which includes probabilistic information measure and entropy, source coding and source coding theorem, prefix coding and Huffman codes, mutual information and channel capacity concepts, Shannon theorems. It also covers fundamental limits for communication systems, capacity for the bandlimited AWGN channel, and asymptotic behaviour.

MODULE V: ERROR CONTROL CODING

This module covers error correction coding principles (encoding and decoding), block codes and syndrome decoding, Hamming and cyclic codes, Reed-Solomon and BCH codes, error detecting and ARQ versus forward error correction. It also covers the elementary concepts of convolutional codes and Viterbi decoding.

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

1. Recognize and develop signal space representations for digital modulation methods.
2. Compare the strengths, weaknesses, and requirements of different digital modulation techniques.
3. Compress data to use less channel bandwidth without sacrificing information by using source coding techniques.
4. Protect transmitted data from noise and interference by employing channel coding methods.

GRADING

Method	**Weight**
Assignment	20%
Written CA Test	20%
Written Exam	60%
Total	**100%**

300 LEVEL
SECOND SEMESTER

CMEN308: INTEGRATED CIRCUITS AND SYSTEMS DESIGN (2 Credit Units)
OBJECTIVES:

1. To know the process of electronics components material processing
2. To know the fundamentals of diodes design, types, operation and applications
3. To know the fundamentals of BJT and JFET and MOSFET transistors design and application
4. To know the fundamentals of fabrication of electronics components

MODULE I: ELECTRONIC MATERIALS
Atomic structure of matter, Energy levels in an atom, Energy band theory of solids, Conductors, Insulators, Semi-conductors, Conductivity in crystalline solids, Conductivity in semiconductors, Intrinsic semiconductors, Extrinsic (doped) semiconductors, Mass-action law and carrier concentrations, Transportation of electric current, Drift in an electric field, Temperature effect

MODULE II: DIODES (PN JUNCTION) DEVICES
Formation of PN junction, Diode current and voltage relationship, Operation of diode, Avalanche breakdown, Zener breakdown, Temperature effects on diodes, Power capacity of diodes, Capacitance of diodes, Definition of some terms, Applications of diodes, Voltage rectification,
H*alf wave rectifier and* F*ull wave rectifier,* Voltage doubling, Diode as clipper (limiter), Diode clipper classifications, Diode as clamper, Schoktty diode, Introduction to light and emitted photons (light), Light emitting diode, Operation and light emission process of LED, LED biasing process, LEDS seven segment display, Two colours led emitter, Applications of LEDs, Photodiode, PN photodiode, PIN photodiode, Avalanche photodiode, Photodiode operation modes, Zener diode, Zener regulator

MODULE III: BIPOLAR JUNCTION TRANSISTORS
Photo transistor, Bipolar junction transistor, Transistor circuit, Common-emitter (CE), configuration, Common-base (CB) configuration, Common-collector (CC) configuration, Transistor operation parameters, Applications of transistor, Transistor as an amplifier, Transistor as an oscillator, Transistor as a switch

MODULE IV: FIELD EFFECT TRANSISTOR (JFET & MOSFET)
Junction FET (JFET), N-channel JFET operation, P-channel JFET operation, Transfer characteristics of JFET, JFET specification sheet, Metal-oxide semiconductor FET (MOSFET), N-channel MOSFET, P-channel MOSFET, Enhancement type of N-channel MOSFET, Enhancement type of P-channel MOSFET

MODULE V: BIASING AND APPLICATIONS OF FETs, SILICON CONTROLLED RECTIFIER
FET Biasing, Fixed Bias Configuration, Self-Bias Configuration, Voltage-divider Biasing Configuration, Applications of field effect transistors: FET as a voltage controlled variable resistor, JFET as a voltmeter, JFET

as a timer network, MOSFET as relay driver, Silicon control rectifier (SCR), Operation of SCR, Applications of SCR, SCR as automatic battery charging control, SCR control of full-wave bridge rectifier

MODULE VI: FABRICATION OF ELECTRONIC DEVICES
Fabrication techniques, Fabrication materials, Fabrication procedure, Preparation of base intrinsic materials, Growth of crystal, Oxidation, Etching, Diffusion, Fabrication of transistors, Fabrication of diodes, Fabrication of resistors, Fabrication of capacitor, Photo masking, Metallic connections, IC packaging

LABORATORY PRACTICALS
1. Simple analog and digital circuit implementation experiments with emphasis on the block diagram of the IC used
2. Boolean functions implementation experiments using digital MOS ICs
3. Timing circuits experiments using timer ICs (555-Timer)

Learning outcomes

At the end of this course the students are expected to:

1. Understand the process of electronics components material processing
2. Understand the fundamentals of diode design, types, operation and applications
3. Understand the fundamentals of BJT and JFET and MOSFET transistors design and application
4. Understand the fundamentals of fabrication of electronics components

GRADING

Method	**Weight**
Lab Practicals	20%
Written CA Test	20%
Written Exam	60%
Total	**100%**

CMEN310: INTRODUCTION TO ELECTRONICS (2 CREDIT UNITS)

OBJECTIVES:
1. Students shall understand the various types of power supply, configurations, rectification and waveforms.
2. Students shall be able to know the architecture, characteristics and configuration of BJT. They will be able to analyze bot DC and AC load lines.
3. The principle of operation, constructions details and characteristics of FET amplifiers with graphical analysis shall be known by the students.
4. The student will be introduced to cases of amplifiers, distortion and harmonics with analysis of power output and efficiency.
5. Students shall be introduced to the basic characteristics of Op-Amp and their different configurations.
6. Students shall be able to know the concept and effect of feedback on gain, distortion, bandwidth, input and output impedances. The student should also know the types of oscillators with details on them.

MODULE I: POWER SUPPLIES
This module will present the various types of power supply, configurations, rectification and their respective waveforms.

MODULE II: BJT AMPLIFIERS
This module will expose the students to the BJT construction, operational characteristics and configurations. It will also introduce the student to Operating point, DC and AC load lines, Biasing circuits, Bias stability and stability factor. Moreover, thermal runaway, classification of cascaded amplifiers, gain-bandwidth product, RC and transformer coupling will be learned in addition to the low, medium and high-frequency equivalent circuits, Small-signal T- and h-parameter equivalent circuits and Design of BJT amplifiers.

MODULE III: FET AMPLIFIERS

This module shall introduce the student to various Constructional details and characteristics of JFETs and MOSFETs, RC coupled JFET and MOSFET amplifiers. The students will also be introduced to the functions of the circuit component, graphical analysis for DC and AC load lines and different biasing arrangements.

MODULE IV: AUDIO POWER AMPLIFIERS
The module introduces the student to the classes of amplifiers, amplifier distortion and harmonics. It also exposes the student to the power output and efficiency of amplifiers, push-pull amplifiers and complementary symmetry are also explained.
MODULE V: OPERATIONAL AMPLIFIERS

The module shall introduce the basic Op-Amp characteristics and circuits to the student. Difference types of amplifier circuits and configurations will also be explained. Finally, the module will bring about the idea of analog computation.

MODULE VI: OSCILLATORS

The module shall introduce the student to feedback concepts, the effect of feedback on gain, distortion, bandwidth, input and output impedances and various feedback circuits. The various types of oscillators and analysis on them will be introduced as well.

Learning Outcomes
Students that successfully complete this course should be able to:

1. Understand how the various power supplies, configurations, types of rectifications and waveforms are with basic analysis on them.
2. Know the architecture, characteristics and configuration of BJT and be able to analyze DC and AD load line.
3. Explain the principle of operation, constructions and characteristics of FET amplifiers. The student should also be able to know how to analyze the FETs graphically.
4. Know cases of amplifiers distortions and harmonics and can be able to analyze their power output and efficiency.
5. Know the characteristics of Op-Amp and their different configurations.
6. Know the concept and the effect of feedback on gain, distortion, bandwidth, input and output impedances and type of oscillators.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN312: TELECOMMUNICATIONS PRINCIPLES (2 Credit Units)

OBJECTIVES:

1. Introduce the different telecommunication networks and the function of their constituents
2. Introduce signal modulation and the properties of communication links.
3. Explain the principle behind the conversion of information signals between digital and analog forms
4. Introduce the concept and type of signal multiplexing
5. Introduce the need for and methods used for error control over communication links
6. Introduce radio communication systems
7. Introduce metrics for telecommunication system performance evaluation

MODULE I: OVERVIEW OF TELECOMMUNICATIONS SYSTEMS
In this module, students will be introduced to different telecommunications system networks, components and functions of different subsystems of a communications link, and limitations of a communication link.

MODULE II: SIGNAL MODULATION AND TRANSMISSION (ANALOG AND DIGITAL)

This module will explain and analyze basic analogue and digital modulation techniques. It will also explain the transmission power and bandwidths requirements and the use of the decibel (dB) unit of measure of power.

MODULE III: INFORMATION SIGNAL TRANSMISSION

Module three will introduce students to the principles of analog/digital signal conversion over a digital/analog transmission link.

MODULE IV: SIGNAL FLOW AND MULTIPLEXING

This module will explain flow control and basic multiplexing techniques (i.e., FDM, TDM, CDM).

MODULE V: ERROR CONTROL

The principles of error detection and correction will be explained in this module. Simple error detection and correction techniques will be introduced.

MODULE VI: RADIO SYSTEMS, TRANSMITTERS, RECEIVERS AND FILTERS

This module will introduce students to the propagation of radio waves and components responsible for controlled quality signals transmission and reception.

MODULE VII: PERFORMANCE EVALUATION OF TELECOMMUNICATION SYSTEMS

This module will explain the main factors which limit the spectral performance of telecommunications systems (i.e., noise, bandwidth, power). It will introduce students to the analyses of signal-to-noise ratio (SNR), bit error rate (BER), energy per bit to noise spectral density $\left({}^{E_b}/_{N_o}\right)$.

LABORATORY PRACTICALS

Amplitude shift keying

Learning Outcomes

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

1. Identify and describe the functions of the main building blocks of a generic telecommunications system.
2. Understand the principles of analogue and digital modulation techniques and multiplexing.
3. Evaluate system performance in terms of SNR and BER.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

400 LEVEL

FIRST SEMESTER

CMEN 401: DATA COMMUNICATION (2 Credit Units)

OBJECTIVES:

1. Students should understand the information theory.
2. Understand the baseband digital communication
3. To examine and understand error detection and correction
4. Understand the band pass digital transmission
5. Understand signals and transmission media
6. Understand OSI and TCP/IP reference models
7. Understand data communication networking

MODULE I: INFORMATION THEORY
Students should understand the basics of information measure, entropy and information rate.

MODULE II: BASEBAND DIGITAL COMMUNICATIONS
The module will expose students to understand digital signaling format, line encoding, errors in digital transmission and error models

MODULE III: ERROR DETECTION AND CORRECTION
This module introduces students to coding theory, abstract algebra, source coding and channel coding. The module also covers classification of codes, ARQ systems and FEC systems.

MODULE IV: BANDPASS DIGITAL TRANSMISSION
This module introduces students to various modulation techniques. It also provides the students with basic performance of modulation in fading channels as well as criteria governing modulation selection.

MODULE V: SIGNALS AND TRANSMISSION MEDIA
In this module, students will be exposed to types of signals and how analog and digital data can be transmitted over the media. It also introduces students to various forms of guided and unguided media and the mode of signals propagation in the media

MODULE VI: PROTOCOLS ARCHITECTURE
This module will introduce students to the need of protocol architecture, OSI and TCP/IP reference models and their architectures, standardization within the OSI framework. It also exposes students to the TCP/IP layers TCP and UDP, operation of TCP and IP and also their application

MODULE VII: DATA COMMUNICATION NETWORKING
This module will expose students to wide area networks, wireless area networks, local area networks and metropolitan area networks.

LABORATORY PRACTICALS

1. Frequency shifting principle
2. Digital to analog conversion

Learning Outcomes

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

1. Understand the fundamentals concepts of data communication.
2. Identify different components of data communication and their respective role in computer communication.
3. Apply the knowledge and concepts related to data communication.
4. Design a data communication link.
5. Solve problems related to data communication by choosing suitable techniques.
6. Appreciate the usefulness and importance of computer communication in our lives.
7.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%

Total	**100%**

CMEN 405: DIGITAL ELECTRONICS II (2 Credit Units)

OBJECTIVES:
The course shall provide students with:
1. Understanding of basic logic gates
2. Analysis of sequential circuits
3. Design of multi vibrators
4. Design of memory cells
5. Interpretation of manufacturers data sheets

MODULE I: BASIC LOGIC GATES
This module will present the various design principles of logic gates such as DCTL, TTL etc and logic gate ICs. It will also introduce design of combinational logic circuits.

MODULE II: SEQUENTIAL LOGIC GATES
This module will introduce student to various flip flops, counters, shift registers and analysis of sequential logic gates

MODULE III: MULTIVIBRATORS
This module introduces students to monostable and astable multivibrators using CMOS, operational amplifiers and the 555 timer.

MODULE IV: MEMORY CELLS
This module will introduce student memory cells-static RAM cells, dynamic RAM cells, ROM, PROM, EPROM, E2PROM and sense amplifiers.

MODULE V: DATA SHEET TIMING DIAGRAM
Students will be taught how to interpret manufacturer's data sheets.

LABORATORY PRACTICALS
Construction of multivibrator circuits using the 555 timer and other components

Learning Outcomes

By the end of the course students should be able to:
1. Use digital logic gates in designing circuits
2. Design and understand principles of operations of sequential logic circuit
3. Build and test logic circuits involving multivibrators.
4. Design memory cells
5. Use data sheet information to successfully design electronic circuits

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

500 LEVEL
FIRST SEMESTER

CMEN501: INTEGRATED CIRCUITS AND SYSTEMS DESIGN (2 Credit Units)

OBJECTIVES:

1. To know integrated circuits (ICs) are and the different types
2. To know the materials used for IC design and the basic design process
3. To understand the process of timing in IC design and operation
4. To know how to evaluate the performance of ICs
5. To know the basic computer program used for IC design and simulation

MODULE I: MATERIAL PROCESSING AND BASIC DESIGN CONCEPT
Introduction to VLSI technology, MOS transistor theory, Inverter circuits, Data and control flow, MOS processing and design rules.

MODULE II: PRINCIPLES OF IC DEVELOPMENT
Integration and system fabrication, Logic design with MOS

MODULE III: TIMING CONCEPT IN IC DESIGN
Architecture and design of system controllers, System timing, Highly concurrent systems and their suitability for VLSI implementation

MODULE IV: CIRCUIT DESIGN AND ELEMENTS EXTRACTION
Signal processing using MOS technology, Standard cell design methodologies with emphasis on layout design, Circuit and parasitic element extraction and verification of circuit performance via simulation tools

MODULE V: SOFTWARE ASPECT OF IC DESIGN
Design of functional blocks of digital ICs using SPICE

LABORATORY PRACTICALS
4. Simple analog and digital circuit implementation experiments with emphasis on the block diagram of the IC used
5. Boolean functions implementation experiments digital MOS ICs
6. Timing circuits experiments using timer ICs (555-Timer)

Learning outcomes

At the end of this course the students are expected to:

1. Know what is IC and its types
2. Know the materials used for IC design and the basic design process
3. Understand the process of timing in IC design and operation
4. Know how to evaluate the performance of ICs
5. Know the basic computer program used for IC design and simulation

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN503: TELECOMMUNICATIONS NETWORKS I
OBJECTIVES
1. Describe the key elements of voice and data communications networks.
2. Explain the principle of higher multiplexing hierarchies
3. Explain the principle and applications of circuit- and packet- switching techniques
4. Explain multimedia communications and systems,

5. Introduce key access technologies and their characteristics

MODULE I
Introduction to: - communication networks and services, network hardware, voice and data networks. The rapidly changing world of telecommunications

MODULE II
PCM Systems, Plesiochronous digital hierarchy (PDH), Synchronous digital hierarchy (SDH)

MODULE III
Packet switching, circuit switching, network control and signaling packet network technologies, internet technologies

MODULE IV
Multimedia systems, multimedia communications and processing

MODULE V
Introduction to access network technologies including xDSL, PONS, Fiber Coax. Evolution and potential of ATM, ADSL and PONS, multiservice networks

Learning Outcomes

1. A comprehensive knowledge of the underlying technologies of digital communication networks and data transport technologies for use in access and core networks
2. A comprehensive knowledge of the underlying technologies of packet-based networks and the use of this knowledge to analyse the different components and layer functionality of such networks.
3. An understanding of the fundamentals of circuit switching and the multi-stage switching arrangements and the use of such knowledge to design and analyse optimum switches with varying degrees of availability and complexity
4. An understanding of the functional differences between circuit switched and packet switched networks and between connection oriented and connectionless architectures
5. Ability to identify and classify the key metrics required to assess the quality of service (QoS) in IP-based networks and then to optimise network operation.
6. Ability to investigate and define various types of networks appropriate for pre specified applications and operation scenarios.

GRADING

Method	**Weight**
Report/Presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 505: INFORMATION THEORY AND SOURCE CODING (2 Credit Units)

OBJECTIVES:

1. Introduce students to information theory and measures of information
2. Explain the need for and the different types of source coding
3. Introduce students to the different communication channel models
4. Introduce and explain the concept of channel capacity

MODULE I: BASIC CONCEPTS
Definition of information, unit of information, sources of information, concept of entropy as a measure of information (H), rate of information

MODULE II: MEASURE OF INFORMATION
Joint entropy, conditional entropy, mutual information, and properties of mutual information

MODULE III: SOURCE CODING
Source coding techniques and analyses: Huffman source coding, Shannon-Fano coding and their comparative analyses in terms of coding efficiency

MODULE IV: CHANNEL MODELING
Types of channel models and their transition matrices: discrete memoryless channel, symmetric channel, noiseless channel, lossless channel, binary symmetric channel, binary erasure channel

MODULE V: CHANNEL CAPACITY
The concept of channel capacity. Shannon's capacity theorem and its implications. Shannon-Fano source encoding, Huffman source encoding. Comparative analysis of the two source encoding techniques in terms of code length and coding efficiency

Learning Outcomes

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

1. Understand the basic concepts of information theory
2. Model and analyze basic information channel models
3. Understand and analyze the two basic source encoding techniques.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 507

CMEN 509

CMEN 511

CMEN517: DIGITAL SIGNAL PROCESSING (2 CREDITS UNITS)
OBJECTIVES

1. to understand the concept of signals and systems, and perform basic operations on signals and systems
2. to convert analog signals to digital signals
3. to understand the concept and application of z-transform.
4. to perform discrete time fourier transform,
5. Design digital filters for given performance specifications

MODULE (I): GENERAL OVERVIEW

Definition of Digital Signal Processing(DSP), generic block diagram. Comparison with analogue signal processing, Advantages, disadvantages. Applications. Relationship with other scientific and engineering disciplines.

MODULE (II): SIGNALS

Definition. Distinguish between analogue and digital signals. **Representation of discrete-time signals**; graphical, functional, tabular, sequential. Elementary discrete time signals. **Basic operations on sequences**; time shifting, time reversal, time scaling, amplitude scaling, signal addition, signal multiplication. **Classifications of discrete-time signals;** deterministic and random signals, periodic and aperiodic sequences, energy and power signals, even and odd signals

MODULE (III): SYSTEMS

Definition. N of discrete-time systems; static and dynamic systems, causal and non-causal systems, linear and non-linear systems, shift variant and shift-invariant systems, stable and unstable systems, FIR and IIR systems, invertible and non-invertible systems. Classifications of discrete-time signals; deterministic and random signals, periodic and aperiodic sequences, energy and power signals, even and odd signals

MODULE (IV): DISCRETE CONVOLUTION AND CORRELATION

Definition. Impulse response and convolution sum. Analytical evaluation of convolution. Linear convolution using graphical method. Discrete correlation; cross correlation, autocorrelation

MODULE (V): SAMPLING

Introduction. Sampling theorem. Effects of under-sampling. Sampling techniques; ideal sampling or impulse sampling, natural sampling, flat top sampling.

MODULE (VI): Z-TRANSFORM

Definition. Region of Convergence (ROC), advantages of z-transform. Z-transform and ROC of finite duration sequences; right-sided sequence, left-sided sequence. Properties of ROC. Properties of Z-transform. Inverse z-transform using long division method. Applications of Z-transform.

MODULE (VII): REALISATION OF DISCRETE TIME SYSTEM

Direct Form-I structure of realizing FIR system. Direct form-I structure of realizing IIR system

MODULE (VIII): DISCRETE-TIME FOURIER TRANSFORM(DTFT)

Definition. Existence of DTFT. Relationship between z-transform and Fourier transform. Inverse DTFT. Properties of DTFT. Discrete Fourier transform(DFT). Relationship between DFT and Z-transform

MODULE (IX): DIGITAL FILTERS

Definition. Description of the principle of operation of a digital filter. Design of FIR filter using window method. Finite word length problem. Principle of adaptive digital filter

LEARNING OUTCOMES

Students that successfully complete this course should be able to:

1. Define and characterize signals and systems with a view to performing basic operations on the signals and systems.
2. Perform signal operations of analog – to – digital conversion
3. Perform the different type of Fourier transforms on discrete-time signals.
4. Realize discrete time systems in software or/and hardware.
5. Design FIR digital filter using window method .

GRADING

Method	**Weight**
Report/presentation	20%

Written CA Test	20%
Written Exams	60%
Total	**100%**

500 LEVEL
SECOND SEMESTER

CMEN502: RADIO COMMUNICATION (2 Credit Units)

OBJECTIVES:

Students shall:

1. Understand the concept of radio frequency (RF), sky wave propagation and effects of ionosphere and solar activity. Students must be familiar with the technique used to predict propagation in a stated medium.
2. Understand the design and basic operation of some microwave passive component.
3. Understands the principle of operation of frequency generation circuits.
4. Understand the principle of operation of RF amplifier circuits.
5. Have a sound understanding on the design and analysis of radio system.

MODULE I: RF FUNDAMENTALS
Microstrip techniques; Scattering parameters; Ionosphere; Troposphere; ground, sky, and space wave propagation; Multipath; Loss and fading.

MODULE II: RF COMPONENTS
Directional couplers/duplexes, quadrature hybrids, circulators, isolators, attenuators, and microstrip filters.

MODULE III: RF FREQUENCY GENERATION CIRCUITS
Oscillator circuits, Digital frequency synthesizers, Mixer circuits, Frequency multiplication circuits.

MODULE IV: RF AMPLIFIER CIRCUITS
Low noise amplifier, Intermediate frequency amplifier, Power amplifiers.

MODULE V: RADIO SYSTEM DESIGN
Fade margins, System gain, Frequency diversity, Space diversity, Angle diversity, Adaptive equalization, Radio link design, CCIR recommendations related to system designs.

MODULE VI: WAVEGUIDES AND CAVITY RESONATORS

Waveguides: Rectangular waveguide; TE and TM modes, excitation of modes, power transmission and power losses. Circular waveguide;TE and TM modes, excitation of modes, power transmission and powerlosses. **Resonators:** circular and semi-circular cavity resonators, the Q of a cavity resonator.

Learning Outcomes

By the end of the course should be able to:

1. Explain the concept of transmission link, S-parameter, matching network and propagation in space.
2. Explain basic operation of some microwave passive components.
3. Explain how frequency generation circuits operate.
4. Describe and explain the properties of RF amplifier circuits
5. Design a radio link.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%

Written Exams	60%
Total	**100%**

CMEN 504: TELECOMMUNICATION NETWORKS (3 Credit Units)
OBJECTIVES:

1. Student will learn the different applications of telecommunication networks and understand the current state of the telecommunications industry.
2. Student will learn the 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it**.**
3. Student will acquire the knowledge of the basic protocols involved in wired and wireless communication process.
4. Students will learn the basic design principles of broadband wired and wireless communication networks (802.11x) in the business environment.
5. Student will learn about the need for network security practices in organizational units.
6. Students will acquire basic knowledge on various concepts of classical computer and network security paradigms.

MODULE I: INTRODUCTION TO TELECOMMUNICATION NETWORKS
This module covers the underlying engineering principles and overview of telephone networks, computer networks, and integrated networks. It also covers the basic concepts and terminology for telecommunications networks, evolution of networks and services - PSTN, ISDN, Internet, and mobile services.

MODULE II: OSI LAYERED NETWORK ARCHITECTURE
This module covers the concept of layered architecture modelling; Open system interconnection (OSI) reference model; Services and service access points; Functions of the OSI Layers; TCP/IP protocol suite; and Client-server communications.

MODULE III: TELETRAFFIC AND TELEPHONE NETWORK
This module covers the purpose of teletraffic theory; Network level switching principles which include circuit switching, packet switching, cell switching; Public Switched Telephone Network (PSTN); Digital Subscriber Line (DSL); Synchronous Optical NETwork (SONET)/Synchronous Digital Hierarchy (SDH); Asynchronous Transfer Mode switching (ATM); Routing which include basics of routing, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP); Congestion control.

MODULE IV: LOCAL AREA NETWORKS
This module covers local area network technologies including ETHERNET, Token Rings; Multiple-access schemes such as CSMA/CD, CSMA/CA and Token-passing; MAC addressing; Switched vs. shared ETHERNETs; Internetworking devices; Network layer protocols, including IP, ARP and ICMP; IP addressing schemes and subnetting; Internet routing protocols; Transport layer protocols; Ports and sockets; TCP connection establishment; Error, flow and congestion control in TCP; Applications layer protocols such as HTTP, FTP, DNS, SMTP, TELNET.

MODULE V: NETWORK SECURITY
This module covers security considerations in business applied network systems architectures and approaches in facing possible intrusions and intrusion detection; Motivation and introduction to information security; Overview of the discipline of cryptography; Authentication protocols including Kerberos and PKI; Overview of computer and network threats and attacks; Contemporary network defence countermeasures; Planning and implementing security policies.

Learning Outcomes

Upon successful completion of the course, students should:

1. Be able to state the requirement for layered approach and explain the basic concept of layering in the network model.
2. Know and understand the traffic engineering principles and the basic measures of traffic and use these to estimate traffic statistical parameters and analyse networks capacity.

3. Be able to analyse the functional differences between circuit switched and packet switched networks and between connection oriented and connectionless architectures.
4. know how routing is carried out in large open networking environment and the operations of major routing protocols such as RIP, OSPF and BGP.
5. Be able to discuss the design principles of wired and wireless communication networks.
6. Be able to explain the fundamentals and technologies of physical, data-link and network layers of the OSI reference model.
7. Have a basic knowledge on the fundamentals of cryptography such as symmetric/asymmetric encryption, digital signatures, and hash functions.
8. Be able to discuss and explain current network authentication applications, PKI, Web security and their vulnerabilities that are exploited by intentional and unintentional attacks.

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN506: OPTICAL FIBRE COMMUNICATIONS (2 Credit Units)
LEARNING OBJECTIVES:

1. To understand the principle of light propagation along a fibre optic cable
2. To identify the important characteristics of light
3. To describe fibre optic cable construction
4. To describe different types of fibre optic cables according to their index profiles and their characters
5. To understand the main losses that occur in a fibre optic cable
6. To perform fibre optic link design using the power budget

MODULE (I): OVERVIEW OF FIBER OPTIC COMMUNICATION SYSTEMS

Evolution, nature of light, generic block diagram of fiber optic communications system. Need for fiber optic communication . Advantages and applications

MODULE(II) : OPTICS REVIEW
Basics of transmission of light rays: properties of light, reflection, refraction, diffusion. Ray theory transmission: Total internal reflection, acceptance angle, numerical aperture, skew rays,

MODULE(III) : CLASSIFICATION OF OPTICAL FIBRES
Index profiles; step index multimode, graded index multimode, step index monomode. Their characteristics, advantages, disadvantages, applications

MODULE(IV) : FIBER LOSSES
Attenuation, scattering; linear and non-linear. Absorption; material absorption and extrinsic absorption. Fiber bend losses. Dispersion; intra modal dispersion, intermodal dispersion, Polarisation mode dispersion.

MODULE(V) : OPTICAL TRANSMITTERS
Light emitting diode(LED): optical output power-current characteristics, output spectrum, lifetime, rise/fall time, modulation response. Semiconductor laser diode, basic principles of laser action in semiconductors, principle of operation of Fabry-Pero resonator.

MODULE(VI) : OPTICAL RECEIVERS
Principle of optical detection. Important parameters of photodetectors. Avalanche photodiode and PIN photodiode. Their characteristics and applications.

MODULE (VI): SYSTEM DESIGN AND PERFORMANCE:

System design: Power budget. Rise time budget. Sources of power penalty. Simplified design procedure.

Learning outcomes

1. Understood the principles governing the propagation of light along a fibre optic cable
2. Understood and explain the losses that occur in fibre optic cable.
3. Understood different types of optical fibers in terns of their index profiles
4. Understood the factors that limit the performance of fibre optic transmission systems

Grading

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 508: SATELLITE COMMUNICATIONS (2 Credit Units)
OBJECTIVES:
The primary goal of the course is to provide the students an understanding of the fundamentals of satellite communications and the types of satellite communication services. Satellite links, i.e. uplinks and downlinks, are explained and differentiated. The subsystems of satellite communication systems are described. Satellite orbits, orbital laws, orbital perturbations and means of maintaining desired orbital position are also presented in this course. Students are also presented with the concept of satellite link budget and its importance is explained.
MODULE I: INTRODUCTION
Describe, using block diagram, a generic satellite communications system. Introduce the basic satellite communications services: Fixed satellite service (FSS), Mobile satellite service (MSS), Broadcast satellite service (BSS). Satellite frequency bands. Explain why downlink frequency is always lower than the uplink frequency

MODULE II: SATELLITE SUBSYSTEMS
Explain the functions of the main satellite subsystems: Communications subsystem; monitoring and control subsystem; antenna system

MODULE III: ORBITS
Derive equation of the orbit. State and describe Kepler's orbital laws. Explain Hohmaan's principle of orbit launching.

MODULE IV: ORBITAL LAWS
Categorization of satellite orbits according to their altitude above the earth. Explain characteristics of the orbits in terms of round trip delay, viewing period, speed.

MODULE V: ORBITAL PERTURBATIONS
State and describe the main types of orbital perturbations. Explain the principles of satellite attitude control and station keeping

MODULE VI: SATELLITE LINK BUDGET
Explain the concept of link budget. Derive expressions for: uplink budget, downlink budget, overall link budget. Explain the practical significance of each segment.

Learning Outcomes

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

1. Describe the basic components of a satellite communication system, understand the basic services it provides and the frequency bands of operation
2. Describe the functions of the main satellite subsystems.
3. Understand satellite orbital laws
4. Understand THE sources and types of orbital perturbations and how to correct their effect through attitude control and station keeping
5. Understand the concept of link budget and its application in satellite link design

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 510: WIRELESS AND MOBILE COMMUNICATIONS (2 CREDIT UNITS)
OBJECTIVES:

1. To understand the key technical challenges for wireless communications
2. To understand the cellular concept and how it is implemented as well as its limitations
3. To understand the limiting effects of interference on cellular system capacity and other metrics
4. To understand the propagation mechanisms in the mobile environment
5. To understand the basic structure of cellular network and functions of the main building blocks.
6. To understand the main functions of key telecommunications standard bodies in setting standards and managing radio

MODULE I: WIRELESS COMMUNICATIONS
Introduction: Types of wireless services; wireless local area networks, Ad Hoc Networks, Sensor Networks, personal area networks. Requirements for the services; Data rate, range and number of users; Mobility, energy consumption, use of spectrum. Technical challenges of wireless networks; multipath propagation, spectrum limitations, limited energy, user mobility.

MODULE II: CELLULAR CONCEPT
Introduction, The basic building blocks of cellular concept; frequency re-use, handover/handoff, location management. Choice of cell shape, clustering, system capacity, frequency re-use distance, re-use factor. Cluster size, Traffic flow methods; frequency division duplex (FDD), time division duplex (TDD), how to find nearest co-channel neighbours, channel assignment strategy, hierarchy of cells by size and cellular spectrum

MODULE III: INTERFERENCE
Sources and descriptions of Co-channel interference (CCI), adjacent channel interference (ACI). Determination of Signal to-interference ratio and system capacity. Mitigation techniques against CCI and ACI.

MODULE IV: CELLULAR NETWORK
Generic block diagram of a cellular network . Description of the functions of the main building blocks; base transceiver station(BTS), base station controller(BSC) mobile switching center(MSC), Home location register(HLR), visitor location register(VLR), authentication center(AUC), equipment identity register(EIR) etc.

MODULE V: HANDOVER/HANDOFF
Introduction, Types of handover; hard handover, soft handover. Handover operation/procedure. Performance metrics. Mobile positioning techniques; network based, handset-based.

MODULE VI: HANDOVER/HANDOFF
Introduction, Types of handover; hard handover, soft handover. Handover operation/procedure. Performance metrics. Mobile positioning techniques; network based, handset-based.

MODULE VII: WIRELESS PROPAGATION MECHANISMS
Introduction, Free space propagation model. Reflection; ground reflection (2 ray model). Diffraction; knife-edge diffraction model. Introduction to fading; slow fading and fast fading

MODULE VIII: MULTIPLE ACCESS TECHNIQUES
Introduction, Descriptions of the following multiple access techniques: frequency division multiple access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA). Advantages and disadvantages

MODULE IX: EVOLUTION OF CELLULAR MOBILE TECHNOLOGIES
1G TO 5G: characteristics, limitations, and applications. Introduction to MIMO, OFDM

Telecommunications standard bodies; ITU, 3GPP, ETSI, AINSI, IEEE; Their functions.

Learning Outcomes
By the end of this course students should have understood:

1. The types of modern wireless services, their requirements limitations
2. The cellular concept and the limitations imposed by interference on system capacity and quality of service
3. The key propagation impairments
4. How handover is effected when a mobile crosses the cell boundary.
5. How telecommunications standard bodies st operational standards and management thee radio spectrum

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 514: DIGITAL SWITCHING SYSTEMS (2 Credit Units) CORE
LEARNING OBJECTIVES

1. To understand the principles of communication switching
2. To understand the functions of digital switching systems
3. To describe different types of switching systems
4. To analyse congestion in a switching matrix
5. To understand the concept and applications of signaling
6. To understand the structure of SS7 signalling protocol and its functional elements

MODULE I: Principles of Communication Switching
Concept of switching and signaling. Functions of a switching system. Electronic switching. Digital switching systems. Classes of switching systems: space division switch, time division switch, frequency division switch

MODULE II: Time Division Switching
Space and Time switching, Time division switching networks Time multiplexed space and time switching, Combination switching and 3 stage combination switching. Call blocking within the switch matrix.

MODULE III: Types of Switching Techniques
Circuit switching, packet switching, message switching, cell switching, frame relay. Switching Techniques for Data Transmission: Circuit switching, Message Switching and Packet Switching Relative Merits and Demerits

MODULE IV: Control of Switching Systems
Call-processing functions. Common control. Stored-program control. Computer controlled switching systems

MODULE V: Packet Switching
Statistical multiplexers. LAN and WAN. Large-scale networks. .Broadband network

MODULE IV: Signalling Systems
Concept. Channel associated signalling. Common channel signaling. Comparative analysis.Customer line signaling, PCM signaling, inter-register signalling

MODULE V: SS7 Signalling
SS7 signalling between exchanges SS7 signalling networks. The structure of SS7 signalling: message transfer part(MTP), telephone user part(TUP), , integrated service user part(ISUP), signaling connection controlpart(sccp) Mobile user part

LEARNING OUTCOMES

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

1. Understand and explain the concept of switching and signalling in the telecommunications networks environment.
2. Describe the evolution of switching systems.
3. Distinguish between channel-associated and common-channel signalling systems.
4. Explain in-depth, time-division switching and packet switching.
5. Understand different types of switching techniques

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN 514: TELETRAFFIC ENGINEERING (2 Credit Units)

OBJECTIVES:

1. Introduce teletraffic engineering and explain its purpose
2. Describe the different teletraffic models and the characteristics of teletraffic
3. Introduce the different switching modes, teletraffic measures and models
4. Explain network planning and dimensioning to minimize data loss and delay

MODULE I: BASIC CONCEPTS
In this module, students will be introduced to the purpose and foundation theory of teletraffic engineering, teletraffic models, classical model for telephone traffic, classical model for data traffic

MODULE II: TRAFFIC CHARACTERISTICS
In this module, students will learn about traffic intensity, arrival and holding time probability distributions

MODULE III: LOSS AND DELAY SYSTEMS
In this module, students will learn about Erlang B and C formulae and their applications, network delay and blocking probabilities

MODULE IV: SWITCHING MODES
In this module students will learn the principles of the following basic switching modes: circuit switching, packet switching, cell switching.

MODULE V: TRAFFIC MEASUREMENTS AND MODELING
In this module students will learn about traffic measurements and variations, traditional modeling of telephone traffic, novel models for data traffic

MODULE VI: NETWORK PLANNING AND DIMENSIONING
In this module students will learn about the elements of congestion and the basic techniques of controlling it.

Learning Outcomes

At the end of this course, students should:
1. Understand the basic concepts of teletraffic engineering
2. Be able to measure and analyze teletraffic data
3. Understand the causes of congestion in a network

GRADING

Method	**Weight**
Report/presentation	20%
Written CA Test	20%
Written Exams	60%
Total	**100%**

CMEN516: COMMUNICATION POWER SYSTEMS (2 CREDIT UNITS)

OBJECTIVES:
Students shall:
1. Understand the importance of Communication power system
2. Understand energy storage system (Electrochemical batteries), their classification and mode of operation.
3. Be familiar with inverter and converter principle of operation, Classification of inverter and converter, precautions for using an inverter and converter, functions and performance of an inverter and converter, operation of stabilizer and digital power supply.
4. Understand the principle of operation of frequency generation circuits.
5. Understand design and operation of Photovoltaic power system, and converter.
6. Understand the concept of AC and DC power and load connection.

MODULE I: INTRODUCTION
Communication power system requirements and applications. Ampere-Hour capacity, etc

MODULE II: EXCHANGE POWER PLANT
Energy storage. Types of cells: Lead-acid storage batteries, alkaline storage batteries, enclosed cells, glass box cells. Evaluation of selected secondary batteries: electrical, operational and comparative characteristics. Maintenance of storage batteries. Maintenance modes. Charging of storage batteries. Charge-discharge mode. Standby and buffer modes of operation. Charging devices. Semiconductor AC-DC converters (rectifiers). Motors. Generators

MODULE III: PRINCIPLES OF INVERTER CIRCUITS
Controlled rectifier: theory and characteristics. Inverter principles (rectification, inversion, etc). Mechanical and transistor switch inverters. Phase controlled rectifiers and AC line voltage commutated inverters. Series, parallel capacitor commutated inverters. Inverter voltage control. Improving inverter output waveform. DC-DC inverter-rectifier. Time ratio control (TRC).Variable frequency TRC. Constant frequency TRC. Converter for stepping up voltage. SCR DC-DC power converters (push-pull, flyback and forward converters.). AC-DC converter design. Power supplies using ICs. DC-DC high voltage power supply. DC-DC supply with multiple outputs. SCR voltage stabilizer. Special purpose power supplies: digital power supplies. Uninterrupted power supplies (UPS) block schematics. Programmable power supplies.

MODULE IV: PHOTOVOLTAIC GENERATORS
Elements of photovoltaic power systems. Fabrication of cells. Design of a converter.

MODULE V: POWER AND LOAD CONNECTIONS
Power board. AC supply leads and standards. AC common and grounding leads. Isolation transformer. AC line regulation. Load connections: DC output characteristics. DC distribution terminals (DT). Decoupling capacitors. Ground return points.

LEARNING OUTCOMES

Students that successfully complete this course should be able to:

1. Describe the significance of communication power system to the fields of Electronics and Telecommunications Engineering.
2. Explain energy storage system (Electrochemical batteries), their classification and mode of operation.
3. Explain inverter and converter principle of operation, Classification of inverter and converter, precautions for using an inverter and converter, functions and performance of an inverter and converter, operation of stabilizer and digital power supply.
4. Explain Photovoltaic power system, and design a simple converter.
5. Explain the concept of AC and DC power and load connection.

1. List of Academic Staff

S/No	P/JP No	Names	GENDER	PRESENT RANK	HIGHEST ACADEMIC QUALIFICATION	OTHER QUALIFICATIONS	AREA OF SPECIALIZATION	REMARK
1	P.04,106	BUBA G. BAJOGA	MALE	Prof.	Ph.D.	M.Eng, BSc	Electronics and Telecommunications Engineering	Contract
2	P.22,183	USMAN ALIYU DANJUMA	MALE	READER	PhD	M.Eng, BSc	Electronics and Telecommunication Engineering	Tenure
3	P. 17, 338	SULEIMAN GARBA	MALE	READER	PhD	M.Eng, B.Eng	Computational Intelligence	
4	P18690	KABIR AHMAD ABUBILAL	MALE	SL	Ph.D.	MSc, B.Eng	Electronics Engineering	
5	P.19,579	ABDUOLIE MOMODOU SUNKARY TEKANYI	MALE	SL	PhD	M.Eng, B.Eng	Data Communication	Contract
6	P.21112	SULEIMAN MUHAMMAD SANI	MALE	SL	PhD	MSc, BSc	Telecommunications Engineering	Contract
7	P.18821	HASSAN ABDULKARIM ABUBAKAR	MALE	SL	PhD	MSc, BSc	Electronics and \telecommunications	Tenure
8	P.17364	ABDU-AGUYE UMAR-FARUK	MALE	L1	PhD	M. Eng, B. Eng	Electronics Engineering	
9	P20400	Z. M. ABDULLAHI	MALE	L1	M.Eng	B.Eng.	Electronics and Telecommunications Engineering	
10	P22169	MU'AZU JIBRIN MUSA	MALE	L1	M.Sc.	BSc.	Electronics and Communications Engineering	Study Leave
11	P23667	YARO ABDULMALIK SHEHU	MALE	L1	M.Eng	BSc.	Signal Processing and Communications	Study Leave
12	P20,399	MOHAMMED DIKKO AL-MUSTAPHA	Male	L2	M.Eng	BSc	Electronics and Telecommunications Engineering	Study Leave
13	P22284	ELVIS OBI	MALE	L2	M.Sc.	B.Eng.	Mobile Communications and Signal Processing.	
14	P22283	OCHIA OKECHUKWU EMMANUEL	MALE	L2	M.Sc.	BSc.	Electronics and Telecommunications Engineering	Study Leave
15	P.23867	SURAJO MUHAMMAD	MALE	L2	M.Eng	B.Eng	Electronics and Telecommunications Engineering	
16	P22895	KABIR MAHMOUD TUKUR	MALE	L2	M.Eng.	B.Eng.	Electronics and Telecommunications Engineering	Study Leave
17	P.23739	FAHAD ABDU JIBRIN	MALE	L2	M.Sc	B.Eng	Telecommunications and Software Engineering.	Study Leave
18	P22162	ISMAIL K. MUSA	MALE	Asst. L	M.Phil	B.Eng.	Electronics and Telecommunications Engineering	
19	P23923	MIKAIL SHAMSUDEEN ABDULLAHI	MALE	L2	M.Sc.	BSc.	Satellite and Mobile Communications	
20	P23917	ISIYAKU YAU	MALE	L2	M.Sc.	BSc.	Optical Communications Engineering	

2. List Technical Staff:

S/No	P/JP No	Names:	GENDER	PRESENT RANK	HIGHEST ACADEMIC QUALIFICATION	OTHER QUALIFICATIONS	AREA OF SPECIALIZATION
1	P17497	Ogbole Mathew Adeka	MALE	Asst. Chief Tech	B. Eng		Communications Engineering
2.	P19525	Samaila Bako Parah	MALE	Senior Technical	OND(Eng)		Electronics Engineering
3.	P18397	Jerome Olorunpomi	MALE	Senior Technical	OND(Eng)	Adv. Tec. Cert	Electronics Engineering
4.	P19440	Mustapha Suleiman	MALE	Principal Tech. Officer	HND	ND	Communications Engineering
5.	P18395	Abdulkarim Buhari	MALE	Senior Technical	ND(Eng)	ND	Electronics Engineering
6.	P22353	Aminu Abubakar S	MALE	Higher Tech Officer	HND(Eng)	ND	Electronics Engineering
7.	P22335	Musa Abdullahi Hudu	MALE	Higher Tech Officer	HND(Eng)	ND	Electronics Engineering