Electrical Engineering Technology - Higher National Diploma (HND)

CURRICULUM AND COURSE SPECIFICATIONS

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Foreword

Sponsored by the UNESCO-Nigeria Project in Support of Revitalisation of Technical and Vocational Education in Nigeria

General Information

The Higher National Diploma (HND) programme in Electrical/Electronic Engineering Technology is designed to impart on the students specialised and useable skills in this field of Engineering. There are three options currently available in the programme, viz:-

(a) Electronics and Telecommunications
(b) Electrical Power and Machines
(c) Instrumentation and Control

A student is required to specialise in one option

Goal and Objectives

Electronics and Telecommunication

The programme is aimed at producing Higher Technicians in electronic engineering for the manufacturing, assembling and servicing industries. On completion of the programme, the diplomate should be able to:-

a. Solve practical problems in electronic engineering by analysis and experimentation;
b. Construct and design complex electronic circuits for use in modification or as a part of major construction;
c. Erect, assemble and install electronic equipment and systems;
d. Carry-out routine maintenance and repairs of electronic installations, equipment and systems;
e. Apply the basic principles of management to manage engineering industries.

Electric Power and Machine

The programme is designed to produce Higher Technicians in Electrical Engineering for the manufacturing, power generation, transmission, distribution and utilization industries. On completion, the diplomate should be able to:-

a. Solve practical problems in electrical engineering by analysis and experimentation;
b. Design complex electrical installation, wiring and circuit projects using appropriate connections;
c. Erect, assemble and install electrical equipment and system;
d. Prepare detailed bills of quantities and specifications related to electrical engineering works.
e. Commission and operate relevant equipment and installations

Instrumentation and Control

The programme is aimed to produce a higher technician in instrumentation and control who will be knowledgeable and skilful in the installation and repairs of instruments.
On completion of the programme, the diplomate should be able to:

1. Assemble and install instrument and control systems
2. Design simple instrumentation and measuring systems;
3. Analyse and solve practical problems in analytical instruments and control systems

Entry Requirement

The general entry requirements for the HND programme include:

1. All the requirements for admission into the ND programme;
2. A minimum of lower credit pass (CGPA 2.50 and above) in the ND examination in Electrical/Electronic Engineering Technology;
3. A minimum of one year cognate work experience

Curriculum

The curriculum of the HND programmes consists of three main components: These are:

i. General Studies/Education
ii. Foundation Courses
iii. Professional Courses

The General Studies/Education component shall include courses in Communication Skills in English, Engineers in the Society, Industrial Management etc. The General Education component shall account for not more than 15% of the total contact hours for the programme.

Foundation Courses include courses in Mathematics and Statistics. The number of hours may account for about 10-15 percent of the total hours. The professional courses are courses which give the students the theory and practical skills he needs to practice his field of specialisation. They may account for between 60-70 percent of the contact hours.

Curriculum Structure

The structure of the HND programme is similar to that of the ND except that SIWES at the end of the first year is not compulsory.

Accreditation

Each option of the programme shall be accredited by NBTE before the diplomates can be awarded the Higher National Diploma Certificate. Details about the process of accrediting a programme for the award of the HND are available from the Executive Secretary, Programmes Division, National Board for Technical Education, Plot B Bida Road, P. M. B. 2239, Kaduna.

Condition for the award of the HND

Institution offering accredited programmes will award the Higher National Diploma to candidates who successfully completed the programme after passing prescribed course work, examinations, and diploma project. Such candidates should have completed a minimum of between 72 and 80 Semester Credit Units. Diploma shall be classified as follows:

1. Distinction:-GPA of 3.50 and above
2. Upper Credit:- GPA of 3.00 and 3.49
3. Lower Credit:- GPA of 2.50 and 2.99
4. Pass:- GPA of 2.00 and 2.49
5. Fail:- GPA of below and 2.00

Guidance Note for Teachers Teaching the Programme

The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stress the need to introduce the semester credit units which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.

In designing the units, the principle of the modular system by product has been adopted; thus making each of the professional modules, when completed provide the student with technician operative skills, which can be used for employment purposes.

As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has been written in behavioural objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomates of the programme.

There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performances are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution.

Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the Polytechnic system.

The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practice in the ratio of 50:50 or 60:40 or the reverse.

Log book

A personal Log-book to be kept by the students shall contain all the day-to-day, weekly summary, and Semester Summary, or all the practical activities from day one to the end of the programme. This is to be checked and endorsed by the lecturers concerned at the end of every week

Curriculum Table

HND PROGRAMME IN ELECTRICAL ENGINEERING TECHNOLOGY

FIRST SEMESTER HND I

Course Code	Course Title	L	T	P	CU	CH
MTH 311	Advanced Algebra	2	1	-	3	3
SDV 210	Business Entrepreneurship	2	-	-	2	2
MEC 311	Engineer in Society	2	-	-	2	2
EEC 315	Electrical Material Science	2		-	2	2
EEI 311	Electrical Measurement and Control III	2	-	3	2	4
EEC 313	Electric Circuit Theory III	2	1	-	3	3
ICT 302	Computer Packages	2	-	3	3	5
EEE 314	Analogue Electronics III	2	-	2	3	5
	TOTAL	**16**	**2**	**8**	**20**	**26**

SECOND SEMESTER HND I

Course Code	Course Title	L	T	P	CU	CH
MTH 312	Advanced Calculus	2	1	-	3	3
GNS 413	Industrial Management	2	-	-	2	2
EEC 324	Testing Method and Reliability	2	-	-	2	2
EEC 325	Electrical Circuit Theory IV	2	-	-	3	3
EEP 328	Electrical Design and Drawing I	1	-	3	2	4
EEE 325	Digital Communication I	1	1	3	3	4
EEP 326	Electric Power Systems III	2	-	3	3	5
EEP 327	Electric Machines III	2	-	3	3	5
ICT 321	Data Communication and Networking	1	-	2	2	3
	TOTAL	**15**	**2**	**14**	**23**	**31**

INSTRUMENTATION AND CONTROL

THIRD SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
EEI 435	Instrumentation Design and Drafting	1	-	3	2	4
EEI 437	Pneumatic Instrumentation	1	-	2	2	3
EEC 431	Electromagnetic Field Theory	2	-	-	2	2
MTH 321	Numerical Methods	2		-	2	2
EEE 435	Digital Communication II	1	-	3	2	3
EEE 434	Analogue Electronics IV	2	-	3	3	5
EEC 433	Control Engineering III	2	-	3	3	5
EEI 431	Electrical Measurement and Control IV	1	-	2	2	3
EEC 437	Project	-	-	3	1	3
	TOTAL	**12**	**-**	**19**	**19**	**31**

FOURTH SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
EEI 442	Electronic Instrumentation	1	-	2	2	3
EEI 444	Process Measurement	2	-	3	3	5
EEI 446	Instruments Maintenance and Repairs	-	-	3	1	3
MTH 313	Statistical Methods	2		-	2	2
ICT 301	Introduction to Computer Programming (C++)	1	-	3	2	4
EEC 447	Project	-	-	3	1	3
	TOTAL	**6**	**2**	**14**	**11**	**20**

ELECTRONICS AND TELECOMMUNICATION

THIRD SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
MTH 321	Numerical Methods	2	-	-	2	2
EEC 431	Electromagnetic Field Theory	2	-	-	2	2
EEE 437	Electronic Design and Drafting	1	-	3	2	4
EEE 435	Digital Communication II	1	-	3	2	4
EEE 434	Analogue Electronic IV	2	-	3	3	5
EEI 431	Electronic Measurement & Control IV	1	-	2	2	3
EEE 438	Microprocessor Applications	1	-	3	2	4
EEC 433	Control Engineering System III	2	-	3	3	5
EEC 437	Project	-	-	3	1	3
	TOTAL	**12**		**20**	**19**	**32**

FOURTH SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
MTH 313	Statistical Methods	2	1	0	3	3
EEE 446	Electronic Maintenance & Repairs	-	-	4	1	4
EEE 445	Digital Communication III	2	-	3	3	5
EEE 447	Computer Hardware Maintenance & Repairs	-	-	2	1	2
ICT 301	Introduction to Programming (C++)	1	-	3	2	4
EEC 447	Project II	-	-	3	1	3
	TOTAL	**5**	**1**	**15**	**11**	**2**

POWER AND MACHINE

THIRD SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
MTH 321	Numerical Methods	2	-	-	2	2
EEP 436	Electrical Power System IV	2	-	3	3	5
EEP 439	Electric Machines IV	2	-	3	3	5
EEP 438	Electrical Design & Drafting II	1	-	3	2	4
EEC 431	Electromagnetic Field Theory	1	1	-	2	2
EEC 433	Control Engineering III	1	-	3	2	4
EEI 431	Electrical Measurement & Control IV	1	-	2	1	3
EEC 437	Project I	-	-	3	1	3
	TOTAL	**10**	**1**	**17**	**16**	**28**

FOURTH SEMESTER HND II

Course Code	Course Title	L	T	P	CU	CH
MTH 313	Statistical Methods	2	-	-	2	2
EEP 446	Electric Power System V	2	1	-	3	3
EEP 447	Electrical Machines V	2	-	3	2	5
EEP 444	Electrical Maintenance and Repairs	1	-	3	2	4
ICT 301	Introduction to Programming (C++)	1	-	3	2	4
EEC 447	Project II	-	-	3	1	3
	TOTAL	**8**	**1**	**12**	**12**	**21**

Computer Courses

Microprocessor Application

General Objective:

PRACTICALS

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

1. Expand memory of a Computer
2. Design and Construct simple MPU based Controllers.
3. Assemble and Perform system setup of a Computer.

LIST OF PRACTICALS

WEEK

1 - 4 Design and Construction of Switching Circuits with Multiplexers

5 - 8 Memory Expansion

9 - 15 Design and Construction of MPU based PID Controllers

General Objectives:

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

1. Understand Structured logic Devices
2. Know the techniques of structured sequential logic Design
3. Distinguish between the various software systems available in the present day computer systems.
4. Know how the computer architecture is organised.
5. Understand a typical microprocessor structure and operation
6. Understand the internal structure and operations of the MC 6800 and 8080 A microprocessor units (MPUS) and their generations.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		**Course Code: EEE 438**	**Contact Hours: 1/0/3 Lecture/Practical simultaneously**
Course Specification: Theoretical Content			
	General Objective 1.0: Understand structured Logic Devices		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1	On completion of this course, the student should be able to: 1.1- Explain the nature and use of multiplexers, demultiplexers, decoders. 1.2- Describe read-only memories and programmable logic arrays as combinatorial logic with and-tie and or-tie sections. 1.3- Appreciate implications of using structured logic devices in combinatorial logic design.	- Demonstrate the use of multiplexers and decoders. - Explain application of read-only memories	- Analogue decoder - Computers magic board/slides
	General Objective 2.0: Know the techniques of structured sequential logic design		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
2 - 3	2.1 Classify digital systems as machines from class 0 to class 4 machines. 2.2 Represent control algorithms in form of a state transition diagram (STD) or algorithmic state machine (ASM) charts. 2.3 Use K-MAPS with MAP-entered variables in complexity reduction. 2.4 Use a formal approach to logic design. 2.5 Use multiplexers, decoders, ROM's and PLA's in structured sequential logic design. 2.6 Appreciate the factors affecting choice of design approach. 2.7 State the limitations of hardwired logic and the justification for using microprocessors.	- Explain the use of k-maps for minimization and maximization	- Magic board /slides

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		**Course Code: EEE 438**	**Contact Hours: 1/0/3 Lecture/Practical simultaneously**
Course Specification: Theoretical Content			
	General Objective 3.0: Distinguish between the various software systems available in the present day computer systems.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
4 - 5	3.1 State the importance of software systems in the total operation of a modern computer system. 3.2 Explain the function of an operating system. 3.3 State the difference between a job-shop and batch system. 3.4 Explain the operation of the following: a. Multi-programming system b. Interactive (on-line) system c. High level language. 3.5 Distinguish between the following computer language: a. Machine Code b. Assembler languages c. High level languages. 3.6 State the merits and demerits of each of the languages in 3.5 above. 3.7 Explain the operation of interpreters and compilers. 3.8 Explain the function of the terminal and monitor in a typical interactive multi-user computer system.	- State examples of operating system - Explain the need for computer languages	- Magic Board/slides

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		Course Code: EEE 438	Contact Hours: 1/0/3 Lecture/Practical simultaneously
Course Specification: Theoretical Content			
	General Objective 4.0: Know how the computer architecture is organised		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
6 - 7	4.1 Define an interface 4.2 State the different between computer interface and external device interface. 4.3 Distinguish between programmable and non-programmable inter-face data transfer. 4.4 Explain the basic elements of unconditional programme transfer: a. Device selector b. Data lines c. Data transfer control lines. 4.5 Explain why the architecture of a memory mapped INPUT/OUTPUT is related to 4.4 above. 4.6 Explain the merit and demerits of unconditional interface data transfer. 4.7 Explain the basic structure of conditional interface data transfer. 4.8 Draw flow charts for a typical conditional interface data transfer routine. 4.9 State the merits and demerits of conditional interface data transfer. 4.10 Explain the basic structure of a simple interface interrupt driven data transfer. 4.11 Draw flow charts of a typical interrupt driven data transfer routine. 4.12 State the merits and demerits of simple interrupt driven interface data transfer. 4.13 Explain the basic elements of a Direct Memory Access interface data transfer (DMA Transfer). 4.14 State the merit and demerits of DMA Interface data transfer.	- Use examples to explain, receiver & channel - Show the difference between decoder and encoder	Magic board/slides

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		Course Code: EEE 438	Contact Hours: 1/0/3 Lecture/Practical simultaneously
Course Specification: Theoretical Content			
	General Objective 4.0: Know how the computer architecture is organised		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
	4.15 Explain the basic elements of a data transmission path: a. Data producer and encoder b. Encoder (e.g. parity encoder) c. Modulator; d. Channel; e. Demodulator f. Decoder; g. Receiver.		
8	4.16 Explain the parameters of a data transmission system a. Speed; b. Reliability; c. Cost. 4.17 Distinguish between serial data and parallel data transfer 4.18 State the merits and demerits of:- a. Parallel data transfer b. Serial data transfer		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		Course Code: EEE 438	Contact Hours: 1/0/3 Lecture/Practical simultaneously
Course Specification: Theoretical Content			
	General Objective 5.0: Understand a typical microprocessor structure and operation		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
9 - 11	5.1 State the differences between mainframe, mini and micro computer systems. 5.2 Define a single-chip microprocessor unit. 5.3 Outline the roles of microprocessors in the design of various instrumentation and control systems e.g. a. Machine tool control; b. Process control; c. Traffic control; d. Automotive electronics; e. Instrumentation of all kinds; f. Electronic games; g. Computer systems; h. Communication systems. 5.4 Perform experiments to illustrate items listed in 5.3 5.5 Explain the evolution of the very large scale integrated (VLSI) microprocessor chip and its likely trend. 5.6 Describe the typical external architecture of a microprocessor based system e.g. the bus architecture specifying:- a. Microprocessor (CPU) b. ROM and RAM c. PLA, PPI and ACIA d. Data, Address and Control buses e. Timing. 5.7 Describe the organisation of a typical micro-processor system specifying:- a. Address lines b. Control lines	- Explain the use of micro computer system - show practically the use of micro processor	- Magic board/slides computers

	c. Methods of selecting memory locally and device registers. 5.8 Explain the various types of storage chips used in micro-processor systems: (a) RAM - Static and dynamic (b) ROM - PROM, EPROM, EROM.		
11 - 12	5.9 Explain why buffering schemes are necessary for micro-processor buses. 5.10 Describe the various buffering schemes:- a. Address bus buffering b. Data bus buffering c. Control bus buffering. 5.11 Describe the structures and operations of interface adapters e.g: a. PIA b. ACIA c. PPI d. VIA etc. 5.12 Perform an experiment to realise buffering using a microprocessor.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: MICRO PROCESSOR APPLICATIONS		Course Code: EEE 438	Contact Hours: 1/0/3 Lecture/Practical simultaneously
Course Specification: Theoretical Content			
	General Objective 6.0: Understand the internal structure and operation of the MC 6800 and 8080 A micro-processor units (MPUS) and their generations		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13 14 - 15	Commercially Available Microprocessor units 6.1 Describe the internal functional blocks of the MC 6800 MPU e.g.: a. Registers; b. Buffers; c. Instruction decoder and controllers. 6.2 Explain the general timing and control signal of the MC 6800 MPU:- a. Address bus; b. Data bus; c. CPU control signals; d. Bus control signals. 6.3 Explain the address modes of the MC 6800 MPU series. 6.4 Explain the instruction set of MC 6800 MPU series. 6.5 Analyse programme examples written in MC 6800 machine language. 6.6 Explain the limitations of the MC 6800 MPU series. 6.7 Describe the internal functional blocks of the 8080A MPU including: a. Register Array and address; b. Arithmetic and logic - + c. Instruction register and control section; d. Bi-direction, 3-state data bus buffer 6.8 Perform an experiment to illustrate the uses and limitations of microprocessors.	- Explain application of micro-processors - Show student microprocessor	- Magic board/slides computers
	ASSESSMENT: Course work 10%, Course tests 10%; Practical 20%; Examination 60%.		

Introduction to Programming C++

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: INTRODUCTION TO PROGRAMMING(C++)		Course Code: ICT 301	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective: The course is designed to enable the student to develop efficient, reliable object oriented program in C++ for engineering use.		
WEEK	Specific Learning Outcomes:	Teachers Activities	Resources
1 - 2	1.1- Introducing Computer High level Languages 1.2 Explain the advantages of High Level Languages. 1.3 Identify the differences between High level and Low level Languages 1.4 Explain some program development tools such as flowchart, pseudo code etc. 1.5 Draw flowcharts to explain the use of each symbol.	- Explain the need for Computer High level Languages. - Demonstrate the use of program development tools. - Explain the concept of OOP.	- Magic board/Slides
3 - 4	2.1 Introduction to Object Oriented Programming 2.2 Introduction to C and C++ Programming Language 2.3 Explain the character set of C and C++ 2.4 Define C and C++ reserved words. 2.5 Explain some features of C++ such as: Abstract data, types, input and output, the result, reuse and extendibility which includes Inheritance, Header files, Late Binding, Inline specification and overloading.	- Make student understand the character set of C and C++ - Explain reserve words with examples - Assist students to appreciate some features of C++ - Explain classes available in C++	- Magic board/slides
5 - 6	3.1 Explain classes in C++ such as: Referencing classes and class members, structuring classes, Declaring Derived classes, Multiple Inheritance constructors and Destructors, static objects. 3.2 Explain overloading functions and operators: Operator overloading and function overloading.	- Show the difference between operator overloading and function overloading.	- Magic board
7	4.1 Discuss Heirs Apparent and friends: Inheritance Vs friendship, specifications. 4.2 Solve some programming problem in C++	- Assist student to know the difference between inheritance and friendship	- Magic board/ Computers and C++ compiler

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: INTRODUCTION TO PROGRAMMING(C++)		**Course Code: ICT 301**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content & Practical Content			
	General Objective: The course is designed to enable the student to develop efficient, reliable object oriented program in C++ for engineering use.		
8	5.1 Discuss interpolations in C++ (Polynomial fitting)	- Explain protected access, Derivative specification with relevant examples.	- Magic board/ computers and C++ compilers.
9-10	6.1 Describe statistical programs in C++ 6.2 Explain the terms correlation, moving averages of a time series, chi-square test of independence.	- Design some problems to be solved using C++	
11-12	7.1 Identify input and output statement 7.2 Explain: Pseudo-Random Number Generation and test such as: Random Number Generator, Normal variate, Randomness test and elementary simulation.	- Make student understand interpolation in C++	
13	8.1 Identify some applications of C++ such as: Turbo C++ Graphics, Addressing the graphics screen, points, colours, lines, shapes, simple Animation.	- Teach student statistical programs in C++ and explain to them correlation, moving averages, chi-square.	- Magic board/ computers and C++ compilers
14-15	9.1 Explain Rag tracing in C++ 9.2 Discuss Rag tracing Application program strategy, Application with graphics, Application with an inside.	- Use examples to explain random	- Magic board/ computer and C++ compilers.
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Computer Packages

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER PACKAGES		Course Code: ICT 302	Contact Hours: 2/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective: To enhance participants skills in data base creation, storage and query		
WEEK	Specific Learning Outcomes:	Teachers Activities	Resources
1 - 2	1.1 Discuss the meaning of data base, its advantages over manual filing 1.2 Introduce Data base concepts and application 1.3 Introduce data types such as text, memo, number, date/time OLE object etc. 1.4 Specify the field size 1.5 Discuss types of data base mgt. Systems such as RDBMS, Network and Hierarchical and appropriate application.	- Illustrate with a file cabinet - Show how students academic records may be maintained on a data base - Show example with name for text salary for number, etc. - Count the alphabets in your name to determine number of spaces to allow for storage.	- LCD and screen
3 - 4	2.1 Construct the data base 2.2 Adding records to structure, querying modifying and deleting records producing reports 2.3 Indexing and sorting 2.4 Record pointer and record navigation buttons	- Determine the name invoke the structure. - Use students records as example enter the records in the structure query modify and produce typical reports with the students. - Show practically how to index and sort a file in alphabetical order - Demonstrate on the computer.	- Computer system with a DBMS such as Access, Oracle, dBase, and Foxpro - Computer - Printer
	3.1 Students project	- Give an academic records assignment to students.	_

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER PACKAGES		Course Code: ICT 302	Contact Hours: 2/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective: To enhance participants skills in data base creation, storage and query		
5 - 6	4.1 State the merits of using AutoCAD 4.2 Display AutoCAD menu system 4.3 Explain the various CAD systems available 4.4 Define AutoCAD Co-ordinates 4.5 Specify AutoCAD Angles 4.6 Specify points and distances using absolute methods and relative coordinates using "@" sign, polar co-ordinates	- Introduce the subject CAD & CAM and their relationship - Explain the advantages of the use of CAD - Show how to invoke AutoCAD and study menu with students - Try typical small drawings with students. - Show how layers are turned on and off.	- Magic Board and flip board - Computer with SVGA monitor and torch pen.
7 - 8	5.1 Expanding & shrinking Area 5.2 Identify Colours and Line types 5.3 Load line types 5.4 Set line-type scale factor 5.5 Turn Layers on and off 5.6 Explain how to Zoom the drawing 5.7 Explain how to Pan the drawing 5.8 Select an object.	- Demonstrate OSNAP on the AutoCAD menu using ENDPOINT etc. - Go to command line on the menu and issue the commands.	- Magic Board and flip board - Computer with SVGA monitor and torch pen
9	6.1 Demonstrate Object shape (OSNAP) 6.2 Issue commands including Line, Circle, DONUT, ARCS, SOLID Polyline, Pline	- Request the student to under take a practice CAD project for evaluation of transfer of skill. - A practical project.	- Computer system with LCD Projector and screen.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER PACKAGES		Course Code: ICT 302	Contact Hours: 2/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective: To enhance participants skills in data base creation, storage and query		
10 - 11	7.1 Discuss the relevance of computer Graphics to the course of study. 7.2 Identify relevant graphical devices (INPUT, OUTPUT, STORAGE and PROCESSING) 7.3 Differentiate among many relevant input devices 7.4 State the advantages and disadvantage of graphical input devices 7.5 Differentiate among graphical output devices. 7.6 State the advantages and disadvantages of graphical output devices. 7.7 Discuss the trends in graphical storage devices. 7.8 Discuss the processing power of processors used for computer Graphics.	- Use questions and answer to discuss generations of output and processing devices. - Go through each of the algorithms and draw flow chart of such algorithm use pseudo code to explain.	- Computer system that has graphical language package installed in it. - LCD projector and screen. - Magic board, digitizer.
12 - 13	8.1 Discuss mathematical algorithms used for 2-D and 3-D objects. 8.2 Explain 3-D graphics pipeline 8.3 Explain clipping 8.4 Explain projection 8.5 Discuss arbitrary viewing 8.6 Explain hidden surface removal and shading	- Demonstrate the procedures used in clipping, projection, hidden surface and shading.	
14	9.1 Demonstrate how 2 - D and 3 - D objects are represented in the language (package) 9.2 Use computer program to implement 3 - D graphics pipeline, clipping, projection arbitrary viewing hidden surface removal and shading.	- Give class assignment to students to produce simple 3-D objects. - Demonstrate the different procedure a. Clipping b. Projection etc.	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER PACKAGES		**Course Code: ICT 302**	**Contact Hours: 2/0/3**
Course Specification: Theoretical Content & Practical Content			
	General Objective: To enhance participants skills in data base creation, storage and query		
15	10.1 Discuss parametric blending techniques 10.2 Model physical and articulated objects.	- Demonstrate parametric blending techniques - Give project to student to model physical and articulated objects.	
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

Computer Hardware Maintenance and Repairs

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER HARDWARE MAINTENANCE AND REPAIRS		Course Code: EEE 447	Contact Hours: 1/0/2.
Course Specification: Theoretical Content & Practical Content			
	General Objective 1.0: Students should be able to diagnose and repair a faulty computer system		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Describe Computer hardware component 1.2 List some input and output devices 1.3 Describe the functions of the I-O units 1.4 Describe the structure and functions of CPU 1.5 List some auxiliary units 1.6 Describe the functions of the auxiliary units 1.7 Define bits, bytes, words and characters	- Teach students different parts of the computer - Show the students the physical components - Give typical examples of each component part - Explain the basic configuration using diagrammatic illustrations.	- Dismantled computer unit - Screw Drivers of different sizes - Digital multimeter - Soldering iron/gm - Soldering lead - Lead removal, Sunction pump - Magnifying lens.
	General Objective 2.0: Identify Basic Modules inside the PC		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
4 - 6	2.1 Name all the components on the motherboard s 2.2 Identify the ditmfferent interface cards (I/O, NIC etc.) 2.3 Recognise Power Units 2.4 Differentiate internal connecting cables 2.5 Identify different storage devices (FDD, HDD, CD-ROM) 2.6 Identify component parts of the monitor and printer 2.7 Recognise BIOS and CMOS CHIPS 2.8 Identify Basic maintenance/Repair Tools; Screw drivers, Testers, Digital multimeters, Soldering iron/gun Zinc/lead remover, Magnifying lens etc.	- Give the students hints to recognize the physical components - Remind students of caution when handling the monitor - Ask students a few questions to be answered verbally - Explain the special features of each. - Raise each tool up for the students to see (may also be passed round the students)	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER HARDWARE MAINTENANCE AND REPAIRS		Course Code: EEE 447	Contact Hours: 1/0/2.
Course Specification: Theoretical Content & Practical Content			
	General Objective 3.0: Diagnosing and Trouble - shooting		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
7 - 8 9	3.1 Explain how to diagnose common faults 3.2 Understand how to troubleshoot common modules for system malfunctions and symptoms relating to common problems. 3.3 Identify common symptoms and problems associated with each module 3.4 Explain how to troubleshoot and isolate problems. 3.5 Understand how to solder 3.6 Identify basic procedures for adding and removing replaceable modules.	- Explain the workins of each tool and how a student can use it. - Give students practical questions to use each tool. - Introduce some faults in a computer for the students to diagnose and isolate. - Assist the students to achieve above.	- Faulty Computer system/component
	General Objective 4.0: Understand Safety and Preventive maintenance Procedures		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
10 - 12	4.1 Identify procedures and devices for protection against environmental hazards: power suppliers, laser devices, high - voltage equipment CRT. 4.2 Recognise components/items that require special disposal procedures that comply with environmental guidelines: Batteries, Toner kits/catridges, chemical solvents, CRTs. 4.3 Identify electrostatic discharge (ESD) precautions and procedures 4.4 Use ESD precautions and protection devices 4.5 State steps and procedures for preventive maintenance.	- Teach students to use soldering iron, multimeters, magnifying lens and sunction pump. - Lead students to couple and uncouple components. - Lead students to appreciate safety procedures. - Teach student the impact of environmental hazarads e.g. CRT affecting eyesight.	- Computer software utility e.g. Norton utility.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: COMPUTER HARDWARE MAINTENANCE AND REPAIRS		Course Code: EEE 447	Contact Hours: 1/0/2.
Course Specification: Theoretical Content & Practical Content			
	General Objective 5.0: Identify Software Maintenance Procedures		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13 - 15	5.1 Demonstrate how to configure hard disks and software 5.2 Install hard disks and software 5.3 Identify the purpose of CMOS 5.4 Identify what CMOS contains 5.5 Understand how to change the basic parameters of CMOS.	- Carry out configuration steps for the student to follow - Lead student in installing software. - Use software utility to demonstrate to student. - Show student how to enter into set-up. - Teach student to modify.	
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

Data Communication and Networking

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 1.0: Understand the definition of Data communication		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Define data communication 1.2 Explain the need for communication between machines 1.3 Know the various equipment used in data (Computer) communications. 1.4 Identify equipment used in Computer communications. 1.5 Explain the functions of on-line equipment. Interactive processing terminals 1.6 Explain the functions of indirect equipment. a. Line controller, line drivers b. Data sets (modems, digital services units). c. Traffic clustering devices: Multiplexers, concentrators d. Network control, front end-processors, Network modes.	- Questions and answers - Teacher should show equipment used in Computer communication. - Explain the functions of other equipment: Network monitoring device diagnostic and testing equipment.	- PC with Network can aid modem with telephone a microwave link - A 10 port hub.
	General Objective 2.0: Understand Modulation Techniques		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
2	2.1 Describe the different types of modulation: Amplitude, frequency and phase. Understand the principles of multiplexing. 2.2 Define multiplexers 2.3 Explain frequency division multiplexing, time division and statistical multiplexing. 2.4 Define a concentrator 2.5 Differentiate between a multiplexer and concentrators. Know the different transmission modes. 2.6 Explain the differences between simplex, half duplex and full duplex transmission. 2.7 Define synchronous and asynchronous transmissions.	- Illustrate with diagrams - Calculate the cost effectiveness of multiplexers. - Questions and answers - Illustrate with dual carriage for full duplex one way for simplex etc.	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 3.0: Know the various forms of line organisation.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
3	3.1 Define line organisation 3.2 Define point - to - point, multi-point and multi-drop organisations know the major communication software. 3.3 Define a communication software 3.4 Explain the functions of the various communication software. Application programmes performance software teleprocessing software line control software.	- Explain the differences between item 1 and item 2. - Give example with procom, internet explorer, nescape navigator.	- PC equipped with explorer e.g. nescape Navigator.
	General Objective 4.0: Understand the concept of computer Network.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
4	4.1 Define a Network 4.2 Evolution of Network 4.3 Computer Technologies modems, multiplexers, computer systems, concentrators etc. 4.4 Carriers (companies that provide Network facilities e.g. NITEL and other ISPs) 4.5 Message transmission.	- Question and answers - Teacher should explain evolution of networks from Multi user operating systems to infrared waves. - Show students different types of channels such twisted pair, coaxial, fiber optics.	- Different types of cables.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 5.0 Explain different types of Network Organisation		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
5	5.1 Technological arrangement a. Peer to peer b. Client server 5.2 Administrative arrangement a. Centralized systems (i.e. server based). b. Distributed systems c. Collaborative systems. 5.3 Geographical arrangement a. Local Area Network (LANS) b. Metropolitan Area network (MANs) c. Wide Area Network (MANS) d. Terrestrial network. 5.4 Network Topologies for LANs a. Star b. Token ring c. Bus 5.5 Explain specific Network a. OSI Model b. ARPANET c. SNA - System network architecture d. DNA - Digital network architecture e. ARCNET.	- Teacher should use computer to demonstrate. - Use Diagrams to illustrate the various Network Topology	- Drawing Paper

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 6.0 Know the various types of media used in data communications/network.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
6	6.1 Explain various transmission links. a. Terrestrial hanks (Bounded media) b. Coaxial cable c. Twissed pair cable d. Fiber optic cable e. Radio wave f. Satelite microwave g. Infrared.		
	General Objective 7.0 Know the various types of Emerging Technologies		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
7	7.1 Teleconferencing a. E-banking, e-commerce, teleconferencing, Telediagnosis Technology b. Message transmission c. Telediagnosis technology d. Medial telediagnosis. e. EDI f. Internet phone g. Internet virtual classroom technology and e-learning.	- Get the student to explore the internet by visiting some sites down load desired information e.g. e-learning sites like skell open university with Holland.	- PC with internet connectivity.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 8.0 Understand communication protocols.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
8	8.1 Define a communication protocols. 8.2 State the function of communication protocol 8.3 Know the ISO reference model on internet protocol 8.4 Differentiate between various transmission media (Asynchronous and synchronous). 8.5 Describe some specific transmission protocols: binary synchronous control, synchronous data link control (SDLC) high data link control (HDCL) x 25 etc. 8.6 Network protocols a. Define network protocols b. Non routable protocols c. Connectionless protocols d. Connection oriented protocols e. Popular protocol suites e.g. i. TCP/IP ii. FTP iii. ICMP iv. SMTP v. IPX/SPX	- Teacher should explain transition or history of protocols. - From bit control protocol. - Explain how protocol works and the level at which they operate. - Show that the level depends on the network itself. - Distinguish between character-oriented protocols and oriented protocols.	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
9	Connecting networks 9.1 LAN connectivity a. Repeaters b. Bridges c. Ethernet hubs d. Routers 9.2 Internetworking devices a. Modems b. Multiplexers c. CSU/DSU d. Gateways 9.3 Network Adapters a. Settings b. Configuration c. Implementation.	- Questions and answers - Demonstration	
10	Network Design and Analysis 10.1 Capacity Assignment in Networks 10.2 Capacity Assignment in Distributed Network 10.3 Concentration and buffering in store and forward Networks 10.4 Network Design Algorithms 10.5 Routing and flow control 10.6 Random Access Techniques 10.7 Line control procedures 10.8 Touting and flow control.	- Demonstration and practices. - Teachers should give students what to do.	- Local Area Network in the school. - Internet connectivity.
11	Network Administration 11.1 User and Security Administration a. Users b. Group Accounts c. Security Types d. Auditing 11.2 Safeguarding Data a. Backups b. Redundant systems c. Uninteruptible power supplies d. Firewalks	- Demonstration and practical work for student on the schools LAN - Demonstration and practical work for students on schools LAN.	- LAN in the schools - Internet connectivity.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objective 9.0: Understand trouble shooting concepts and resources		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
12	12.1 Trouble shooting Basics a. Set the problem priority b. Collect Information c. Determine possible causes d. Isolate the problem e. Solve the problem f. Study the result to confirm the problem has been solved. 12.2 Understand trouble shooting resources available. a. Apply Microsoft download library b. Use Microsoft Tech net c. Use Microsoft knowledge Base d. Visit vendor support sites e. Visit news groups f. Utilize online services g. Make use of publications etc.	Question and Answers Demonstration and practical on the school LAN	LAN is the school.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DATA COMMUNICATION AND NETWORKING		Course Code: ICT 321	Contact Hours: 1/0/2
Course Specification: Theoretical Content & Practical Content			
	General Objectives 10.0: Understand Network Troubleshooting		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13	Understand Network Troubleshooting such as: 13.1 Network Adapters 13.2 The right tool for the job 13.3 Common Network problems and solutions 13.4 Cable problems 13.5 Network Adapters 13.6 Network protocols 13.7 Network traffic congestion 13.8 Broadcast storms 13.9 Network intensive applications 13.10 Power problems.	- Question and Answers - Demonstration	
14	Adding services to your network 14.1 Network printing 14.2 Network faxing 14.3 Sharing CD ROMS and other facilities and media 14.4 Internet Access.	- Demonstration	
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

Electrical Courses

Electrical Circuit Theory III

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 313: ELECTRICAL CIRCUIT THEORY III		Course Code: EEC 313	Contact Hours: 2/1/0
Course Specification: Theoretical Content			
	General Objective 1.0: Evaluate the responses of various networks to a momentary increase of current and voltage		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 6	On completion of this course, the student should be able to:- 1.1 Explain the phenomenon of transients as a response which may finally decay after a time. 1.2 Explain transients in reactive circuits (inductive and capacitive). 1.3 Derive the equation for the growth of current in an inductive circuit (D.C.) 1.4 Derive the equation for the decay of current in an inductive circuit. 1.5 Solve network problems, using the equations derived in 1.3 and 1.4 above. 1.6 Derive the equation of growth and decay of current in R-L-C circuit. 1.7 Apply 1.6 above to the solution of network problems e.g. tuned circuits (parallel & series).	- Demonstrate transients by showing charging and discharging of a capacitor on an Oscilloscope. - Demonstrate the effect of ABCD parameters by using a black box containing simple T - or II - networks, and measuring and calculating the parameter values. - Demonstrate by calculation and measurements the characteristics of various types of filters.	- Oscilloscope tube

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 313: ELECTRICAL CIRCUIT THEORY III		Course Code: EEC 313	Contact Hours: 2/1/0
Course Specification: Theoretical Content			
	General Objective 2.0: Analyse the performance of transmission lines.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
7 - 12	2.1 Define a transmission line 2.2 Explain the general Primary line constants of a transmission line. 2.3 Derive an expression for the propagation coefficient from the primary line constants. 2.4 Define the secondary line constants. 2.5 Derive an expression for the line characteristics impedance. 2.6 Derive expressions for the voltage and current at the ends of an infinite line. 2.7 Define a general termination impedance of a line. 2.8 Evaluates the input impedence, 2.9 Explain the two special cases of line termination: a. Open circuit line; b. Short circuit line 2.10 Solve Transmission line problems by a. Calculations b. Graphical methods.	- Teacher should explain by the use of diagrams	- Graph papers

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 313: ELECTRICAL CIRCUIT THEORY III		**Course Code: EEC 313**	**Contact Hours: 2/1/0**
Course Specification: Theoretical Content			
	General Objective 3.0: Apply graphical methods to the solution of network problems		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
13 - 15	3.1 Explain locus and polar diagrams 3.2 Explain the concept of complex frequency 3.3 Determine amplitude and phase response curves graphically 3.4 Determine amplitude and phase from pole-zero diagrams 3.5 Explain Bode plots. 3.6 Solve related problems in 3.1 to 3.5 above.	- Illuistrate graph by the use of sketches	- Graph paper
	ASSESSMENT: Course work 20%; Course test 20%; Examination 60%.		

Electrical Circuit Theory IV

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 323:ELECTRIC CIRCUIT THEORY IV		Course Code: EEC 323	Contact hours: 2/1/0
Course Specification: Theoretical Content			
	General Objective 1.0: Apply Laplace transform to the solution of electrical network problems.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 2	On completion of this course, the student should be able to:- 1.1. Define the Laplace transform of a given function 1.2 State the transforms of common functions. 1.3 Explain the first shift theorem. 1.4 Define the inverse Laplace transform of a given function. 1.5 Perform partial fraction reduction of a given function. 1.6 Define poles and zeros of a function 1.7 Plot poles/zeros diagram of a function 1.8 Write down the equations for parallel and series RLC circuits in terms of laplace transform. 1.9 Identify the order of the equations in 1.8 above. 1.10 Solve circuit problems using laplace transform. 1.11 Define the Heavi-side unit step function.	- Use questions and answers to demonstrate the use of transforms. - Demonstrate the various circuit theorem through examples and experiments. - Show students a sample of a transmission line. - Point out each components e.g. wire, dielectric, sheath etc.	1.2- Circuit Diagram
2 - 4	1.12 Explain the second shift theorem. 1.13 State the transform of period functions 1.14 Perform the inverse transforms of a periodic function 1.15 Explain the Dira-Delta impulse function 1.16 Define the function f(t-a), f(t), f(t + a). 1.17 Explain the transform of the function f(t-a), f(t) and f(t + a). 1.18 Explain the following theorems and use the theorems in solving problems: a. Initial value theorem b. Final value theorem 1.19 Solve electrical circuit problems involving 1.11 to 1.18.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 323:ELECTRIC CIRCUIT THEORY IV		Course Code: EEC 323	Contact hours: 2/1/0
Course Specification: Theoretical Content			
	General Objective 2.0: Analyse the performance of transmission lines		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
5 - 12	2.1 Explain the general Primary line constants of a transmission line. 2.2 Derive an expression for the propagation coefficient from the primary line constants. 2.3 Define the secondary line constants. 2.4 Derive the expression for the line characteristics impedance. 2.5 Derive expressions for the voltage and current at the ends of an infinite line. 2.6 Define a practical transmission line. 2.7 Define a general termination impedance of a line (Zr.) 2.8 Evaluates the input impedance. (Zs) 2.9 Explain the two special cases of line termination: a. Open circuit line; b. Short circuit line 2.10 Derive expressions for a loss-free line: a. Propagation coefficient b. Attenuation coefficient c. Phase change coefficient d. Characteristics impedance. 2.11 Sketch waveform and current distribution along a line when it is terminated in: a. Short circuit b. Open circuit	- Show students a sample of a transmission line - Point out each components - Demonstrate the various properties of a transmission	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: EEC 323:ELECTRIC CIRCUIT THEORY IV		Course Code: EEC 323	Contact hours: 2/1/0
Course Specification: Theoretical Content			
	General Objective 2.0: Analyse the performance of transmission lines		
13 - 15	2.12 Derive expressions for the reflection coefficient of a line. 2.13 Define voltage standing wave ratio (V.S.W.R.) in relation to: a. Vmax and Vmin, b. Reflection coefficient c. Termination and characteristic impedance. 2.14 Solve problems using 2.1 - 2.13 above. 2.15 Describe the principles of stub matching 2.16 Describe the Smith Chart and its application 2.17 Explain matching of load to line with a quarter wave transformer. 2.18 Explain matching of load to lie with short-circuit stub. 2.19 Describe the effect of frequency variation on line matching. 2.20 Solve transmission line problems by:- a. Calculation b. Graphical methods.		
	ASSESSMENT: Course work 20%; Course test 20%; Examination 60%.		

Electrical Material Science

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MATERIAL SCIENCE		Course Code: EEC 315	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 1.0: Understand various theories and models of the atom		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1- 2	1.1. Describe the Rutherford-Thomson atomic models 1.2 Explain Bohr's theory of the hydrogen atom 1.3 Derive expression for the energy levels of the hydrogen atom 1.4 Explain the following phenomena in terms of 1.2 a. Spectral lines b. Photo-electronic emission c. Electron transmission from one energy level to another	- Teacher should use diagrams to explain	- Drawing paper
	General Objective 2.0: Understand Einsteins and Plancks photo-electric equations and their applications in electrical engineering problems		
Week	Specific Learning Outcome:	Teachers Activities	Resources
3 - 4	2.1 State and explain Einsteins relation 2.2 Compare Ensteins relation with Plancks equation 2.3 Explain the photo-electric effect in terms of 2.1 and 2.2 2.4 Deduce threshold voltage and work function from 2.4.	- Illustrate by the use of diagram	- Drawing paper

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MATERIAL SCIENCE		Course Code: EEC 315	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 3.0 Understand the uncertainty and Pauli principles and their applications to the solutions of problems in electrical engineering		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
5 - 6	3.1 Explain the uncertainty principles of Heinsenberg 3.2 Explain Pauli Exclusion principles 3.3 Apply 3.1 to the solutions of problems on: a. position momentum of electrons b. energy and time of electron transition 3.4 Explain the quantum numbers a. Principal quantum number b. Magnetic momentum quantum number c. Spin quantum number d. Orbital angular quantum number 3.5 Use Pauli Exclusion principle and quantum number to: a. Determine electron configuration in atoms b. Classify the elements in accordance with the periodic table	- Use diagram to explain quantum number	- Drawing paper - Periodic table
	General Objective 4.0: Understand the significance of energy band and their applications		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
7 - 8	4.1 Explain the energy band in solids: a. Valance band b. Conduction band c. Energy gap d. Fermi level 4.2 Explain the properties of conductors, insulators and semi-conductors in terms of energy band structure. 4.3 Explain the overlapping of energy bands in an atom and the effects of such bands.	- Use diagram to explain energy band	- Drawing paper

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MATERIAL SCIENCE		Course Code: EEC 315	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 5.0: Understand the structure of solids and the forces which bind them together:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
9 - 10	5.1 Explain the crystalline nature of solids 5.2 Mention and Describe briefly the following crystal structures: a. Cubic b. Body central cubic c. Face-central cubic d. Hexagonal close pack 5.3 Describe X-ray diffraction to determine crystal structure 5.4 Explain electron-diffraction to illustrate the dual nature of the electron. 5.5 Explain the various types of bonding in solids a. Covalent bond b. Metallic bond c. Conic bond d. Van der Waals bond e. Hydrogen bond	- Use diagram to explain crystal structures - Explain bonding in solids by the use of diagrams	- Drawing paper
	General Objective 6.0: Know the various imperfections in solids and their effects on their properties:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
11 - 12	6.1 Distinguish between disorders and impurities in solids 6.2 Explain various types of disorders and impurities a. Point disorders (vacancies & interstitials) b. Line disorders c. Plane disorders d. Impurities (interstitials, substitutional, precipitates) 6.3 Explain Schotky and Frankel defects	- Demonstrate by the use of diagram	- Drawing paper

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MATERIAL SCIENCE		Course Code: EEC 315	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 6.0: Know the various imperfections in solids and their effects on their properties:		
	6.3 Explain practical applications of imperfections: a. fabrication of semi-conductors (doping) b. manufacture of steel c. alloys d. plasticity etc		
	General Objective 7.0: Understand the thermal and optical properties of materials:		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
13 - 14	7.1 Explain the process of absorption and emission of radiation 7.2 Describe luminescence 7.3 Explain photons and phonons 7.4 Explain surface emission of electrons 7.5 Explain laser beam 7.6 Explain Ionisation of gases 7.7 State practical application of each of the 7.1 to 7.6 above	- Explain the difference between absorption and emission	- Text book
	General Objective 8.0: Understand the important electrical and magnetic properties of some materials		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
15	8.1 Explain piezo-electricity and its applications 8.2 Describe superconductivity 8.3 Explain Hall effect 8.4 State the application of 8.2 and 8.3 above 8.5 Explain magnetic effects a. ferro-magnetism b. ferric-magnetism c. dia-magnetism d. para-magnetism 8.6 List applications of effects in 8.5 above. 8.7 Describe skin effect 8.8 State practical applications of 8.7	Teacher should use diagrams to explain magnetic effect	- Text books
	ASSESSMENT: Course work 20%; Course tests 20%; Examination 60%.		

Electrical Design and Drafting I

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL DESIGN & DRAFTING I		Course Code: EEP 328	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective 1.0: Demonstrate the understanding of electricity supply to various types of consumers		
WEEK	**Specific learning Outcome:**	**Teachers Activities**	**Resources**
1- 3	1.1 Explain the terms: a. Consumer distribution b. Main switchgear 1.2 State various voltage at which supplies are sent to consumers 1.3 Draw main switchgear permissible combinations 1.4 Distinguish domestic premises from non-domestic premises. 1.5 State the types of supplies which are normally sent to domestic premises and non-domestic premises. 1.6 Define consumers control unit, splitter units 1.7 Explain the differences between single-pole, double-pole and triple pole consumer units. 1.8 State the types of fuses normally found in consumer units 1.9 Explain spare ways and the purposes they serve in consumer unit 1.10 Explain the purpose of distribution board 1.11 State the factors to be considered when selecting a consumer unit or distribution board 1.12 State the factors to be considered when selecting a consumer unit or distribution board 1.13 Draw a three phase line in diagram and explain how the loads are balanced on it. 1.14 Define sub-circuits, circuit charts, main circuits. 1.15 Draft typical internal distribution schemes for block of three flats, and multi-storey and identify the various items in the scheme	- Teacher should use diagrams to explain consumer distribution - Give typical examples of consumer distribution	- Distribution board - Cables - Circuit breaker - Transformer - Power

Course: ELECTRICAL DESIGN & DRAFTING I		Course Code: EEP 328	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective 1.0: Demonstrate the understanding of electricity supply to various types of consumers		
4	1.16 Define diversity factors 1.17 Explain how power is supplied to large buildings such as blocks of flats 1.18 Explain the following: a. Main switch gear (lower block) b. Busbar chamber, and c. Rising mains 1.19 Draft rising main busbar system diagram serving high rise flats and explain it 1.20 Explain the use of bare conductor rising mains		
5 - 6	1.21 Draft layout of switchgear for typical office building (including the legends) 1.22 Draft layout diagram for typical factory distribution system (including the legends) 1.23 Explain overhead busbar trunking systems and how they are used to distribute electricity in factories 1.24 Draft an industrial cubicle Switchboard 1.25 Identify the main components on a switchboard. 1.26 Explain how electricity is distributed in farms 1.27 Identify types of equipment used in farm installations 1.28 Explain basic design concepts for the preparation of the electrical drawings for: a. bungalows b. flats c. estates d. block of flats e. factories f. farms 1.29 Design electrical services for the following: a. bungalows b. flats c. estates 1.30 Draft a plan for each of 1.29 above.	- Use diagrams to explain design concepts	- Drawing materials

Course: ELECTRICAL DESIGN & DRAFTING I		Course Code: EEP 328	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective 2.0: Know the selection of cables and the parameters that affect their selection		
WEEK	Specific learning Outcome:	Teachers Activities	Resources
7	2.1 Explain the following terms in connection with cable selection a. Length of run b. Ambient temperature c. Class of excess current protecting d. Grouping of circuits e. Disposition f. Types of sheath 2.2 Identify the various tables in the current IEE Regulations and NSE CAPS used for cables selection 2.3 Explain rating factors and the maximum permissible voltage drop 2.4 Solve problems involving selection for different situations	Explain the different types of cables	IEE Regulations table
	General Objective 3.0: Understand various types of diagrams and use them in various design situations.		
WEEK	Specific learning Outcome:	Teachers Activities	Resources
8 - 10	3.1 Define wiring diagrams 3.2 List the various types of wiring diagrams and their uses. 3.3 State the advantages and disadvantages of various wiring diagrams 3.4 Define point-to-point diagrams 3.5 Draft point-to-point diagrams 3.6 Solve problems involving point-to-point diagrams 3.7 Define baseline diagrams 3.8 Draft baseline diagrams 3.9 Solve problems involving baseline diagrams 3.10 Define highway diagrams 3.11 Draft highway diagrams 3.12 Solve problems involving highway diagrams 3.13 Define lineless diagrams 3.14 Draft lineless diagrams 3.15 Solve problems involving lineless diagrams 3.16 Draft various design using wiring diagrams	Ask students a few questions to be answered by use of diagram.	Drawing materials.

Course: ELECTRICAL DESIGN & DRAFTING I		Course Code: EEP 328	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical Content			
	General Objective 4.0: Understand the basic principles of illustration and the selection of fittings for specific purposes		
WEEK	Specific learning Outcome:	Teachers Activities	Resources
11 - 12 13 - 15	4.1 Explain the following as regards light distribution: a. Direct fitting b. Indirect fitting c. Semi-direct fittings 4.2 Draw: a. Direct fitting b. Indirect fitting c. Semi-direct fitting d. State the purpose for which (i-iii) are used 4.3 State factors which should be taken into consideration when selecting a lamp fitting. 4.4 Explain Maintenance Factor and co-efficient of utilization as used in lumen method of illumination calculation. 4.5 Derive formula for the calculation of number of fittings. 4.6 Identify the various parameters in the formula. 4.7 Solve various problems using the derived formula in 4.5 above. 4.8 Explain point-to-point method of illumination level estimation using the cosine law. 4.9 Solve various problems on illumination level calculations using the cosine law. 4.10 Explain Polar curves. 4.11 Solve problems on illumination. 4.12 Select lamp fitting for various purposes.	Give practical examples	
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Electrical Design and Drafting II

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRICAL MACHINES & POWER OPTION)			
Course: ELECTRICAL DESIGN AND DRAFTING II		Course Code: EEP 438	Contact Hours: 1/0/3
Course Specification: Theoretical Content & Practical content			
	General Objective 1.0: Design and draft industrial motor controls.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	Protection and control system design 1.1 State the regulation pertaining to industrial motor control. 1.2 List symbols used in connection with 1.1 1.3 Define ladder diagram and state its purpose 1.4 Draw a typical ladder diagram and explain how it works. 1.5 Draft standard symbols used in ladder diagrams and identify them. 1.6 Explain how to read ladder diagrams. 1.7 Explain how to draw ladder diagram logically 1.8 Draft the control circuit of an automatic reclosure scheme and explain its operation. 1.9 Identify all the major equipment in the system of 1.8 above. 1.10 State particular areas of its application 1.11 Draft the control circuit of a typical intrinsically safe remote system. 1.12 Identify all the major equipment in the system of 1.11. 1.13 Explain the operation of the system. 1.14 State particular areas of application 1.15 Draft the control circuit diagrams for: a. Direct-on-line starter; b. Star-delta starter; c. Reversing starter. 1.16 Identify all the major components in the system in 1.15. 1.17 Design control circuit diagrams for given engineering situations. 1.18 Draft industrial motor control circuits.	- Sketch diagram for the various starter and state practical applications	- Drawing materials

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRICAL MACHINES & POWER OPTION)			
Course: ELECTRICAL DESIGN AND DRAFTING II		**Course Code: EEP 438**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content & Practical content			
	General Objective 2.0: Understand the elements of Power substation up to 11kV.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
4 - 6	2.1 Explain the IEE and NSE CAP? 2.2 Identify loads to which diversity factor could be applied and those to which it could not. 2.3 Apply "Growth Factor" to load estimation. 2.4 Solve problems on load estimation for transformers, generators and switchgears. 2.5 State the regulations and standards which influence the design and manufacture of switchgears. 2.6 Explain IEC 439 and NSE CAPS which deals with factory built assemblies of switchgears. 2.7 Define industrial switchboard and cubicle switchboard. 2.8 Explain the information required in specifying switch Board. 2.9 Solve problems on calculation of switchgear and cable. 2.10 Explain the layout of a typical scheme in a factory. 2.11 Draft the layout of the scheme.	- Use questions and answer to discuss the various regulations	
	General Objective 3.0: Understand the elements of Power substation up to 11kV.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
7 - 8	3.1 Estimate the load requirement of a medium size factory highlighting. a. Load survey; b. Estimation based on floor area. 3.2 Determine the conductor size for 1.1 above. 3.3 Determine substation location based on load centre. 3.4 Identify substation equipment and explain their uses. 3.5 Select the ratings of the equipment in 1.4 above. 3.6 Draft the layout diagram of the equipment in 5.4 above.	- Assist the students to design and draw substation	- Drawing materials

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRICAL MACHINES & POWER OPTION)			
Course: ELECTRICAL DESIGN AND DRAFTING II		**Course Code: EEP 438**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content & Practical content			
	General Objective 4.0: Understand the purpose of blue prints, how the final design is arrived at and the type of information that could be extracted From blue prints.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
9 - 12	4.1 Explain the purpose of preliminary design. 4.2 State the various statutory regulations, relevant codes of practice and i.e.e. and NSE CAPs Regulations which the design must fulfill. 4.3 Explain final design and the preparation of blue prints. 4.4 Define contract documents and specifications. 4.5 Explain the requirement for preparing estimate for electrical projects. 4.6 Explain the principle of estimating materials from drawing. 4.7 Define: a. Unit rate; b. Cost on site; c. Cost of installation. 4.8 Explain how labour costs are estimated. 4.9 Explain how plants and transport requirements are assessed for a particular project. 4.10 Define the following as applied to electrical contracting: a. Bills of Engineering and Measurement Materials b. Lump sum c. Fixed price d. Fluctuation e. Overhead f. Variation g. Insurance 4.11 Prepare bills of Engineering Management and Materials and write specifications for various electrical designs. 4.12 Prepare a post contract document (PC) for 4.1 to 4.11 above.	- Explain by the use of examples. - A practical project.	- Text books

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRICAL MACHINES & POWER OPTION)			
Course: ELECTRICAL DESIGN AND DRAFTING II		**Course Code: EEP 438**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content & Practical content			
	General Objective 5.0: Understand and apply the various factors necessary when planning and managing electrical projects.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
13 - 15	5.1 Define sub-contractor and identify jobs which could be awarded as a sub-contract. 5.2 Define bar chart. 5.3 Explain master chart and the sub-contractor charts and their uses. 5.4 Draw a bar chart for a building construction programme (main contractors bar chart) and interpret it. 5.5 Draw an electrical contractor's chart from the main contractor's bar chart and interpret it. 5.6 Solve problems on bar chart construction 5.7 Explain the uses of the following:- 1. Site diary 2. Materials record book 3. Accident book. 5.8 State and explain the responsibilities of site supervisors. 5.9 List and explain the things a good site supervisor should know. 5.10 Explain the condition for appointing safety supervisor. 5.11 List types of information that should be passed on to factory inspector.	- Teacher should use graph to explain	- Drawing materials
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Electrical Testing Method and Reliability

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: TESTING METHODS AND RELIABILITY (Condition for Monitoring)		Course Code: EEC 324	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the basic terms and relationships involved in reliability studies		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 Explain the importance of reliability with respect to electrical/electronics 1.2 Define the terms: reliability, failure, item, mean-time to failure (MITF) mean-time-between failures (MTBF) 1.3 Explain the meaning of the following types of failure misuse, inherent weakness, sudden, gradual, partial, catastrophic and degradation failures (wearout) 1.4 Differentiate between instantaneous and proportional failure rates. 1.5 Explain the reliability equations and the related curves when λ is constant, i.e. $R = e^{-t.}$ $Q = I - e^{-t}$, $R + Q = I$, Where R = Reliability and Q = unreliability 1.6 Sketch and label the bathtub diagram (i.e graph of failure rate against time) 1.7 Explain the characteristic failure curves in the bathtub diagram. 1.8 State the probable causes of failure in each of the regions of the bathtub diagram 1.9 Sketch the wearout failure curve 1.10 Interpret the wearout failure curve using normal (Gaussian) distribution. 1.11 Determine the failure rate for a unit from the failure rates of its constituent parts using the relationship: Overall failure rate = basic failure rate λx No. of similar parts weighting factor (environmental) x weighting factor (rating) x weighting factor (Temperature).	- State practical applications and give examples	- Text books

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: TESTING METHODS AND RELIABILITY (Condition for Monitoring)		**Course Code: EEC 324**	**Contact Hours: 2/0/0**
Course Specification: Theoretical Content			
	General Objective 2.0: Appreciate the concept of reliability prediction		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
	2.1 Explain the basic probability rules in relation to Reliability calculation: i. Multiplication and addition rules ii. The Binominal probability distribution 2.2 Determine mathematical expression for the reliability and MTBF of series systems. 2.3 Derive mathematical expression for the reliability and MTBF of systems. 2.4 Determine the reliability and MTBF of series, parallel and non-series, non-parallel systems. 2.5 Explain the meaning and significance of redundancy 2.6 Differentiate between active and passive (standby) redundancy. 2.7 Solve simple problems relating to active and passive redundancy. 2.8 State practical application of active and standby redundancy	_	-
	General Objective 3.0: Understand the causes and remedies of component failure		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
5 - 6	3.1 Explain the cause of failure due to environmental factors i.e effect of temperature, humidity, atmosphere pressure, chemical content and radiation. 3.2 Explain the cause of component failure due to operating stresses i.e effect to operating voltage, current and frequency. 3.3 Explain other causes of component failure due to mechanical stresses such as shock vibration and friction. 3.4 State specific methods of dealing with environmental problems 3.5 Explain 'Derating' as a method of dealing with failure problems caused by operational stresses, i.e. apply the Arrhenius law (the fifth power law) to illustrate derating.	- Explain by using practical application	- Components of electronics e.g Resistors

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: TESTING METHODS AND RELIABILITY (Condition for Monitoring)		**Course Code: EEC 324**	**Contact Hours: 2/0/0**
Course Specification: Theoretical Content			
	General Objective 4.0: Understand the basic principles of maintainability		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
7 - 9	4.1 Define the term " maintainability". 4.2 Explain the importance of maintainability in relation to reliability. 4.3 Define the following terms: a. Utilization factor b. Availability c. Unavailability d. Repairability 4.4 Explain the concept of preventive and corrective maintenance 4.5 State the factors affecting maintainability 4.6 Explain the methods of improving maintainability 4.7 Illustrate graphically the relationship between cost and equipment reliability 4.8 Explain the concept of failure reporting	State practical applications of maintainability	Text books
	General Objective 5.0: Appreciate the purpose of specifications		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
	5.1 Define the term "specifications" 5.2 State the aims and uses of specifications 5.3 List typical items of information that should be included in specifications 5.4 illustrate 5.3 with examples of specifications for typical measuring equipment.	- Use question and answer to explain	- Text books

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: TESTING METHODS AND RELIABILITY (Condition for Monitoring)		**Course Code: EEC 324**	**Contact Hours: 2/0/0**
Course Specification: Theoretical Content			
	General Objective 6.0: Appreciate the need for testing; types of test carried out and the purpose of testing		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
12 - 15	6.1 Explain the meaning of the following terms: a. reliability demonstration test b. reliability acceptance test c. calibration test d. non-destructive test e. testing for packaging and transport f. identification test g. preproduction test 6.2 Give an example of each test stated in 6.1 above 6.3 Explain the relationship between prototype items of equipment. 6.4 State the reason for producing prototype items of equipment. 6.5 Explain the necessity for pre-production testing Explain the different approaches needed when testing prototype, small batch quantities and large batch quantities	- State typical examples of the various test	
	ASSESSMENT: Course work 20%; Course tests 20%; Examination 60%.		

Electromagnetic Field Theory

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTROMAGNETIC FIELD THEORY		Course Code: EEC 431	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 1.0 Understand the Principles and applications of electrostatics		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 State Coulomb's Law 1.1 Apply 1.1 to determine the force on a point charge placed in an external field. 1.2 Determine the intensity of electric field. 1.3 Explain flux density. 1.4 Derive relevant laws relating to static fields e.g i. Causes law ii. Divergence theorem 1.5 Apply the laws in 1.4 to problems involving electric flux density, potential, electrical field force and capacitance. 1.6 Deduce an expression for the energy stored in an electric field. 1.7 Apply 1.7 above to calculate the energy stored in an electric field. 1.8 Explain practical applications of static electrostatic fields e.g lighting discharge, corona.	Explain by using examples	Text books
	General Objective 2.0 Understand the principles and applications of static magnetic fields:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
5 - 7	2.1 Explain the following laws relating to static magnetic fields. a. Biott Savat law b. Amperes law c. Stokes theorem d. Divergence theorem 2.2 Derive the divergence and stoke's Theorem 2.3 Apply (2.1) to solve practical problems. 2.4 Define magnetic flux density and magnetic potential. 2.5 Derive an expression for the energy stored in magnetic field. 2.6 Calculate the energy stored in magnetic fields. 2.7 Explain the practical applications of static magnetic fields.	Assist students to solve practical problems	Text books

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTROMAGNETIC FIELD THEORY		Course Code: EEC 431	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 3.0: Understand the principles and applications of time - varying electro-magnetic fields		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
8 - 10	3.1 State Faraday's law 3.2 Explain Faraday's law 3.3 Derive Maxwell's equations in both differential and integral forms. 3.4 Apply Faraday's laws and Maxwell's equation to solve simple wave equations in free space and in lossless medium. 3.5 Explain practical applications of 3.1 to 3.4 above.	Derive formula for Faraday's Law	Text books
	General Objective 4.0: Understand the principles of applications of plane waves		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
11 - 14	4.1 Review vector analysis 4.2 Explain wave propagation in a. Free space b. Dielectric c. Conductors 4.3 Explain Poynting vector 4.4 Explain dipole radiation 4.5 Explain radiation pressure 4.6 Apply Poynting vectors to solve problems on energy and radiation pressure. 4.7 Describe guided TEM waves. 4.8 Explain the following:- 1. TEM waves between parallel plane conductors 2. Transverse magnetic waves between parallel conductors. 3. Transverse electric waves between parallel conductors 4. Fibre optics	Use sketches to explain waves	Text books

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTROMAGNETIC FIELD THEORY		Course Code: EEC 431	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
15	4.9 Explain the phenomenon of the reflection of EM waves 4.10 Explain the refraction of EM waves. 4.11 Explain total internal reflection of EM waves 4.12 Explain Brewster angle and critical angle. 4.13 Solve problems on reflection and refraction of EM waves. 4.14 Review Vector analysis		
	ASSESSMENT: Course work 20%; Course tests 20%; Examination 60%.		

Engineer in the Society

ENGINEER IN SOCIETY

General Objectives:

1. Understand the historical development of engineering and technology
2. Understand the nature of the engineering family
3. Appreciate the organisation of the engineering profession in Nigeria
4. Understand the roles of the various cadres of engineering personnel in the Nigerian Society
5. Know the engineering professional associations.
6. Know the regulatory body, COREN and the process and requirements for professional registration.
7. Know the provisions of the Acts setting.
8. Understand the progression of engineering personnel along or across cadres.
9. Understand the Codes of Conduct and Fundamental Ethics of the Profession as well as the Canons.
10. Learn the unwritten laws of engineering.

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: ENGINEER IN SOCIETY/		**COURSE CODE: EEC 319**	**CONTACT HOURS: 2/0/0**
COURSE SPECIFICATION: Theoretical Content			
	General Objective. Understand the historical development of engineering and technology		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
1 - 2	1. Technology and Engineering in ancient Egypt, Rome, China, Europe, America. 2. From Military to Civil Engineering. 3. The Industrial Revolution in England and its spread to Europe, Asia and Africa. 4. Modern Technology and Engineering.	- Use examples to explain	- Text books
3	1. Identify the various cadres of the engineering family 2. State the ideal ratio of ratio of the different cadres of engineering personnel required for an engineering project team. 3. Identify the various engineering discipline.		
4	1. Identify the pyramidal structure of the cadres in the engineering profession. 2. Identify the various training Institutions for engineering personnel in Nigeria.		

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: ENGINEER IN SOCIETY/		COURSE CODE: EEC 319	CONTACT HOURS: 2/0/0
COURSE SPECIFICATION: Theoretical Content			
5 & 6	1. Role of Engineers 2. Role of Technologists 3. Role of Technicians 4. Role of Craftsmen		
7 & 8	1. Discuss the Nigerian Society of Engineer 2. Discuss the national Association of Technologists in Engineering 3. Discuss the Nigeria Institute of Engineering Technicians 4. Discuss the National Association of Engineering Craftsmen.		
9 & 10	1. Describe the function of COREN 2. Describe the process of registration 3. Discuss the consequences of non-registration 4. Discuss quackery in engineering		
11	1. Explain the progression of engineering personnel along their cadre. 2. Explain the requirements for transfer from one cadre to another.		
12 & 13	1. Explain the Fundamental Ethics of Engineering 2. Explain the Canons of Engineering 3. State the Codes of Conduct of Engineering personnel.		
14 & 15	1. State and Explain the unwritten laws of engineering in respect of one's: a. Boss b. Colleagues c. Contract work d. Clients.		
	ASSESSMENT: Course work 20%; Course tests 20%; Examination 60%.		

Control Engineering Courses

Control Engineering III

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: CONTROL ENGINEERING III		Course Code: EEC 433	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the various methods of achieving speed and position control and the application		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 5	1.1 Explain the need for speed control in machines. 1.2 Explain the basic principles of speed control on no-load; 1.3 Explain speed control methods in a d.c. meter using: a. field control; b. armature control; 1.4 State the merits and demerits of field control over armature control; 1.5 Explain using graphs, the effect of load torque on speed. 1.6 Explain the performance of speed control systems: a. Without negative feedback; b. With negative feedback. 1.7 Explain with the aid of schematic diagrams the operation of a velodyne speed control system. 1.8 Outline the merits and demerits of velodyne speed-Control system. 1.9 Explain, with the aid of a schematic diagram the operation of a Ward-Leonard speed control system. 1.10 Explain the operation of a speed control system using thyristors.	- Present practical speed control schemes and derive mathematical models. - Solve related problems - Present practical position control schemes and their mathematical models. - Solve related problem.	- Lesson plan - Chalk board.

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: CONTROL ENGINEERING III		Course Code: EEC 433	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
6 - 8	1.11 Explain the need for position control system. 1.12 Draw a labelled schematic diagram of a position control system. 1.13 Explain the operation of a position control system using the diagram in 1.12. 1.14 Explain with the aid of a diagram the operation of a practical position control system e.g. synchro. 1.15 Explain how the performance of a speed/position control system can be improved using any or combination of the following methods: a. Viscous damping; b. Negative velocity feedback; c. Positive acceleration; d. Position plus derivative action; e. Position plus integral. 1.16 Solve problems involving speed and position control.		
	General Objective 2.0: Understand the principle of process control systems and the applications		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
8 - 10	2.1 Explain common types of automatic process control systems: a. Temperature control; b. Liquid-level control; c. Pressure; d. Rate of slow. 2.2 Describe with the aid of a Schematic/block diagram the application of each of the process control systems in 2.1 specifying the following terms: a. set point b. deviation (offset) c. transport delay (distance-velocity lag).	Discuss practical process control schemes. Solve related problems.	Lesson plan Chalk board.

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: CONTROL ENGINEERING III		Course Code: EEC 433	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective: 3.0 Understand and apply the principles of analogue computing and the application		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
11 - 12	3.1 List the basic analogue computer components: a. Operational amplifiers b. Resistors (potentiometer) c. Capacitors d. Diodes etc. 3.2 Explain the basic mathematical operations that can be realised using analogue computers: a. Addition b. Subtraction c. Integration d. Differentiation e. Function generation f. Multiplication g. Division	- Use practical approach to solution of differential equations using operational amplifiers	- Lesson plan - Chalk board.
13 - 14	3.3 Illustrate with associated symbols the implementation of the following functions: a. Multiplication by a constant b. Phase inversion c. Summation d. Integration e. Differentiation f. Summation integration. 3.4 Demonstrate the use of analogue computer to realise the operations in 3.2 and 3.3 above. 3.5 Draw analogue computer flow diagrams to simulate: a. linear equation b. simultaneous equation c. differential equations.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: CONTROL ENGINEERING III		Course Code: EEC 433	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
15	3.6 Draw analogue computer flow diagram to simulate different systems; a. mechanical vibration system b. electrical system c. speed/position control system 3.7 Explain the need of scaling in analogue computing 3.8 Explain amplitude and time scaling 3.9 Solve problems on differential equations involving amplitude and time scaling.		
	ASSESSMENT: Course work 10%; course tests 10%; practical 20%; Examination 60%.		

EXPERIMENTS

1. Perform experiments to demonstrate d.c. motor control using field current and armature current
2. Perform experiments to demonstrate speed control of d.c. motor with
   (i) negative feedback
   (ii) without negative feedback e.g. Ward Leonard system
3. Perform an experiment to illustrate the application of thyristor in speed control
4. Perform an experiment to demonstrate position control.

Electronics Courses

Analogue Electronics III

Course: ANALOGUE ELECTRONICS III		Course Code: EEE 314	Contact Hours: 2/0/2
Course Specification: Theoretical Content			
	General Objective 1.0: Know hybrid parameters and the application in the analysis of transistor amplifiers:		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1 - 4	1.1- Define hybrid parameters (stating their units) of a bipolar transistor in different configurations: a. the input resistance (hi) b. the forward transfer characteristics current gain (hf) c. the reverse voltage transfer ratio (hr) d. the output conductance (ho) e. State their units 1.2 Draw equivalent circuit of transistor amplifier using the hybrid parameters 1.3 Derive expressions, using h-parameters for an amplifier for the following: a. voltage gain b. current gain c. power gain d. input resistance e. output resistance 1.4 Solve relevant problems using the hybrid parameters	- Request students to perform calculations	- Text books

Course: ANALOGUE ELECTRONICS III		Course Code: EEE 314	Contact Hours: 2/0/2
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the construction and principles of operation of semi-conductor devices related to electrical power system.		
Week	Specific Learning Outcome:	Teachers Activities	Resources
5 - 8	2.1 Explain a thyristor as a four layer semi-conductor 2.2 Explain the function of a thyristor using the two transistor analogy. 2.3 Draw and explain the static characteristics (IA/Vak) of a thyristor. 2.4 Draw and explain the dynamic characteristic of a thyristor. 2.5 Derive the D.C. and voltage equations of a thyristor 2.6 Calculate the SCR current and voltage of a thyristor 2.7 Show that the output voltage and current can be controlled by varying the firing angle. 2.7 List the application of a thyristor 2.8 Describe the connections of: a. the diac; b. the triac. 2.9 Explain with aid of sketches the characteristics of: a. disc; b. triac. 2.10 List the applications of triacs and diacs.	- State the applications of thyristor	

Course: ANALOGUE ELECTRONICS III		Course Code: EEE 314	Contact Hours: 2/0/2
Course Specification: Theoretical Content			
	General Objective 3.0: Know the basic principles of operation and the applications of differential amplifiers.		
Week	Specific Learning Outcome:	Teachers Activities	Resources
9 - 10	3.1 Explain with aid of circuit diagram, the operation of differential amplifier circuits: a. with single-ended input; b. with double-ended input. 3.2 Calculate differential voltage gain of amplifier in 1.1 above. 3.3 Explain the construction and operation of differential amplifier circuits with constant current source. 3.4 Explain the term, "Common-mode rejection ratio of a differential amplifier". (CMRR) 3.5 Calculate CMRR of an amplifier giving necessary parameters. 3.6 Explain the construction and operation of practical different amplifier units using integrated circuits (IC). 3.7 Estimate bandwidth of differential amplifiers. 3.8 Solve problems on differential amplifiers and IC. 3.9 State the practical applications of differential amplifiers.	- Demonstrate the effect of feedback both theoretically and experimentally. - Measure the amplitude and frequency of known oscillators. - Demonstrate various types of rectification. - Demonstrate the effect of filters on the output of rectifiers. - Illustrate voltage regulation.	

Course: ANALOGUE ELECTRONICS III		Course Code: EEE 314	Contact Hours: 2/0/2
Course Specification: Theoretical Content			
	General Objective 4.0: Know the basic principles of operation and applications operational amplifiers.		
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-12	4.1 Explain the principles of operation of operational amplifiers (OP-AMP) 4.2 State the Characteristics of an ideal operational amplifier a. infinite input resistance; b. zero output resistance; c. infinite voltage gain; d. infinite bandwidth; e. no output when input voltages are equal f. characteristic, stable with temperature g. no input current h. virtual earth at input; i. inverting and noninverting input terminals. 4.3 Explain the concept of virtual earth in operational amplifier 4.4 Distinguish between the operation of an OP/AMP with inverting and non-inverting inputs. 4.5 Describe with aid of diagrams how operational amplifier can be used as: a. summer; b. differentiator; c. integrator; d. infinite impedance circuit; e. unit gain voltage follower or buffer amplifier. 4.6 Derive the expression for the open-loop gain of an operational amplifier.	Assist students to analyse Op-AMP circuits	Text books

Course: ANALOGUE ELECTRONICS III		Course Code: EEE 314	Contact Hours: 2/0/2
Course Specification: Theoretical Content			
13 - 14	4.7 Explain the applications of an operational amplifier as used in the following circuits. a. Schmitt trigger circuit; b. Constant current generator; c. Voltage level indicator; d. Peak voltage follower Constant voltage source; e. Voltage compraction f. Voltage rectifier circuit; g. Integrator; h. Differentiator; i. Log and Antilog circuit; j. Equalizer circuit; k. Voltage amplifier circuit; l. Oscillators. 4.8 Solve problems involving OP-AMP, using circuits in 4.7 above.		
15	5.1 Define noise as any unwanted composite signal. 5.2 Explain the sources of internal noise; i. FET noise; ii. Transistor noise; iii. White noise, etc. 5.3 State the precautions necessary to minimise the effect of external noise.	Explain the sources of external noise	
	ASSESSMENT: Course work 10%; Course tests 10%; practical 20%; Examination 60%.		

PRACTICALS

	Analogue(ELECTRONIC III) Laboratory Experiments		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 Perform an experiment to determine the following parameters of an amplifier a. Voltage gain b. Current gain c. Power gain 1.2 Perform experiment to determine the frequency response of an amplifier using different loads. 1.3 Perform an experiment to illustrate different coupling methods in amplifier. 1.4 Perform experiment to illustrate the hybrid parameters.		
5 - 8	Design and construction of Differential Amplifier		
9 - 15	Design and construction of operational amplifier		

Analogue Electronics IV

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ANALOGUE ELECTRONICS IV		Course Code: EEE 434	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 1.0: Know the principles characteristics and application of feedback amplifiers:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Explain positive and negative feedback phenomena in amplifiers 1.2 Draw a block diagram of a basic feedback amplifier 1.3 Derive the general expression for stage gain of a basic feedback amplifiers e.g. A_{VF} = Av/(1+Av) 1.4 Explain the following negative feedback types using block diagrams only a. Series-current feedback b. Series-voltage feedback c. Parallel (shunt) current d. Parallel (shunt) voltage 1.5 Explain the effects of applying negative feedback to an amplifier on: a. Gain b. Gain stability c. Distortion d. Noise e. Input/output impedance f. Bandwidth and gain-bandwidth product 1.6 Apply feedbacks principles to practical transistor circuits 1.7 Explain the principles of operation and characteristics of the following circuits 1.8 Solve problems on negative feedback transistor amplifiers, using h-parameters	- Use demonstrative problems to illustrate binary arithmetic. - Use simple battery, switches and bulb connections to demonstrate the effect of various logic functions. - Use problems to illustrate Boolean Algebra Theorems. - Demonstrate the use of sequential circuits.	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ANALOGUE ELECTRONICS IV		Course Code: EEE 434	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the principles of operation, classification and characteristics of oscillators		
Week	Specific Learning Outcome:	Teachers Activities	Resources
4 - 6	2.1 Explain the effect of positive feedback on an amplifier using a block diagram. 2.2 Explain the mathematical conditions for oscillation to occur i.e when the open loop gain is equal to unity and the net phase shift round the loop is equal to 360^{o} 2.3 Explain with aid of diagrams, the construction and operation of the following oscillators circuits: L-C oscillators (Tuned oscillators - tuned base, tuned collector, Hartley, Colpitts, etc) b. R-C oscillators i.e Phase shift and Wien bridge types. 2.4 Derive expression for the frequency of oscillation of the oscillators in 2.3 above 2.5 Explain the factors which affect the stability of an oscillator e.g temperature, d.c power supply, etc. 2.6 Describe methods of improving the frequency stability of oscillator in 2.3 above 2.7 Solve problems relating to RC and LC oscillator using the 2.4 above		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ANALOGUE ELECTRONICS IV		Course Code: EEE 434	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 3.0: Know the principles of operations, characteristics and application of multivibrators and other types of pulse oscillators		
Week	Specific Learning Outcome:	Teachers Activities	Resources
4 - 7	3.1 Explain with aid of circuit and waveform diagrams, the principles of operation of the following multivibrators: a. A stable multivibrator; b. Monostable multivibrator c. Bistable multivibrator 3.2 Explain the need for synchronizing and triggering of multivibrators. 3.3 Explain the principles of synchronization and triggering of multivibrators 3.4 Derive the component values for the design of multivibrator circuits in 3.1 above 3.5 State the applications of multivibrator in digital systems 3.6 Explain the construction and principles of operating a Schmidt Trigger 3.7 Explain the construction and operation of a UJT oscillator 3.8 State the used of Schmidt Trigger and UJT oscillators 3.9 Solve problems involving miltivibrators, Schmidt Triggers and UTJ oscillators.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ANALOGUE ELECTRONICS IV		Course Code: EEE 434	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 4.0: Understand the construction and principles of operation of stabilized power supply		
Week	Specific Learning Outcome:	Teachers Activities	Resources
11	4.1 Explain with aid circuit and waveform diagrams the principles of half and full wave rectification 4.2 Calculate the ripple factor of a half and full wave rectification		
12	4.3 Explain the need for a smoothing circuit at the output of a rectifier 4.4 Describe the circuits that use the following filters: a. The capacitor input filter b. The inductance input filter 4.5 Compare the performance of the filters in 4.4 above, using the output voltage/load current characteristics. 4.6 Explain with aid of diagrams, the following multiplying circuits: a. Voltage doubler b. Voltage trippler 4.7 Explain with aid of sketches, the principle of operation of a three-phase rectifier circuit.		
12 - 13	4.8 Explain the need for maintaining a constant voltage output across a load with varying input voltage. 4.9 Explain overcurrent and overvoltage protection devices 4.10 Explain the need for maintaining a constant voltage output across a load with varying input voltage		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ANALOGUE ELECTRONICS IV		Course Code: EEE 434	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
14 - 15	4.11 Explain with aid of diagrams, the operation of a simple stabilized power supply using: a. Shunt regulation transistor; b. Series regulator transistor c. Shunt/series regulation devices 4.12 Explain the limitation of the various methods of stabilized power supply in 4.10 above. 4.12 Explain the principles of a. Voltage regulator b. Line regulator		

WEEK	EXPERIMENTS		
1	1.1- Perform experiments to determine the effects on voltage gain, input and output impedance, bandwidth, etc of negative feedback amplifiers.		
2	1.2 Perform an experiment to illustrate the principles of operation of the oscillators in 2.3 above		
3	1.3 Determine by experiments the characteristics of the oscillators in 2.3 above.		
4	1.4 Perform experiment to illustrate the principles of: a. Multivibration in 3.1 above b. Schmidt trigger oscillators c. UJT oscillators		
5	1.5 Demonstrate practically, the various methods of stablised power supply in 4.10 above.		
6	1.6 Determine by experiments the rectified output of a circuit with the following filters. a. Capacitor input filter b. Inductance input filter		
7	1.7 Determine by experiment the output characteristics of a 3-phase rectifier.		
8 - 10	1.8 Design and construct Feedback Amplifier		

WEEK	EXPERIMENTS		
11 - 12	1.9 Design and construct Wien Bridge Oscillators		
13 - 14	2.0 Design and construct Stabilized power supply unit		
	ASSESSMENT: Course work 10%; Course tests 10%; practical 20%; Examination 60%.		

Digital Communications I

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: DIGITAL COMMUNICATION I		Course Code: EEE 325	Contact Hours: 1/0/3
Course Specification: Theoretical Content			
	General Objective 1.0: Understand signals and their properties		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 5	1.1 Types of signals. 1.2 Continuous - time signals 1.3 Discrete - time Signals 1.4 Properties of signals 1.5 Fourier series etc.	- Use amplitude spectrum diagram to illustrate and demonstrate the amplitude modulated frequency bands. - Use mathematical problems to further illustrate amplitude modulation. - Use frequency spectrum diagram to illustrate that FM signal has a wider bandwidth than an AM signal.	- Text books
	General Objective 2.0: Understand the principles of digital modulation		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
6 - 10	2.1 Explain the term digital modulation 2.2 Explain the following digital modulation principles: a. pulse amplitude modulations b. pulse position modulations c. pulse width modulation; d. pulse code modulation 2.3 Sketch the spectrum diagram of the systems defined in2.2. 2.4 Analyse the frequency components of a pulse using fourier series. 2.5 Sketch the block diagram of a P.A.M. (pulse amplitude modulation) transmitter and receiver. 2.6 Explain the disadvantages of the PAM system. 2.7 Explain with the aid of sketches, a time division multiplexing principle. 2.8 Solve problems on digital modulation.	- Explain the difference between carrier wave and modulating signal	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: DIGITAL COMMUNICATION I		Course Code: EEE 325	Contact Hours: 1/0/3
Course Specification: Theoretical Content			
	General Objective 3.0: Understand the principles of amplitude and frequency demodulations.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
11 - 15	3.1 Explain the term "demodulation 3.2 Explain the action of a semi-conductor diode as a simple detector. 3.3 Deduce mathematically that the output of a non-linear device with an AM input contains the information signal and other signal components. 3.4 Explain the square law detector 3.5 Derive expression for the output of the square law detector. 3.6 Sketch the output waveform of the square law detector. 3.7 Explain coherent detection principles for detecting DSBSC signals. 3.8 Derive expressions for the output of a coherent detector using analytical methods. 3.9 Describe the operation of a circuit diagram that used the principles of coherent detection. 3.10 Solve problems involving detection of AM waveforms. 3.11 Explain, with aid of diagrams, the operation of the following FM detectors:- a. Forster b. Ratio detector; 3.12 Explain with aid of diagrams the concepts of pre-emphasis and de-emphasis.		
	ASSESSMENT: Course work 10%; Course tests 10% Practical 20%; Examination 60%.		

Digital Communications II

General Objectives

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

1. Design and Construct simple Channel encodes
2. Design and construct simple data modulations
3. Appreciate the role of digital communication in globalization.

LIST OF PRACTICALS

WEEK

1 - 8 Design and Construction of Hamming Code generator and Receiver

9 - 15 Design and Construction of FSK transmitter & PSK transmitter

EXPERIMENTS: DIGITAL COMMUNICATION II

1.1 Experiments on amplitude modulation

1.2 Experiments on F.M and Phase modulation principles

1.3 Experiments on Digital Signal modulation principles

1.4 Experiments on detection of A.M. Waveforms

1.5 Experiments on F.M. demodulation

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		Course Code: EEE. 435	Contact Hours: 1/0/3
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the principles of operation of amplitude and frequency modulated radio transmitters.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 2	1.1 Draw the block diagram of an AM radio transmitter indicating: a. RF Amplifier; b. Oscillator stage; c. Modulator stage; d. AF Amplifier. 1.2 Explain the functions of each stage of the blocks indicated in 1.1 above 1.3 Draw the blocks diagram of an Fm radio transmitter, indicating: a. Af stage; b. Varactor modulator; c. Crystal Oscillator d. AFC circuit; e. LC Oscillator; f. Frequency multiplier; g. Power amplifier. 1.4 Explain the functions of each block in 1.3 above.	- Identify different types of Wave-guide such as a. Elliptic Wave guide b. Coaxil Wave guide c. Circular Wave guide - Show the applications of Micro Wave Tubes. - Identify various Telecommunication Systems. E.g. Rada systems satellite communication systems.	• Am Radio transmitter • FM Radio transmitter
2 - 4	1.5 Explain the types of coupling methods from the amplifier stage to the aerial. 1.6 Describe the types of measuring instruments needed to test a transmitter 1.7 Explain the methods of testing a transmitter. 1.8 Sketch the block diagram of a radio point-to-point system for HF transmission. 1.9 Explain the operation of the type of system used in 1.8 above.		

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		**Course Code: EEE. 435**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the principles of operation of AM, FM radio receivers.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
5 - 7	2.1 Explain with aid of block diagrams, the principles of operation of a double superhet receiver. 2.2 State the advantages and applications of a double superhet receiver. 2.3 Explain with the aid of block diagrams, the principles of operation of AM receivers. 2.4 Explain, with aid of block diagrams, the principles of operation of FM receivers. 2.5 Describe with the aid of a block diagram, the principles of operation of a transreceiver. 2.6 Describe the uses of print-to-point system and a transreceiver.	Explain bandwidth for AM and FM radio receiver	AM, FM, Radio receiver

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		**Course Code: EEE. 435**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content			
	General Objective: 3.0 Know the construction and principle of operation of monochrome and colour TV system.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
8 - 10	3.1 Describe the construction and operation of a typical T.V. camera. 3.2 Explain with the aid of a block diagram, the principle of a monochrome TV Transmitter. 3.3 Explain the generation of line and field synchronization pulses. 3.4 Describe how synchronization signals are added to the video signal in the T.V. camera. 3.5 Describe how sound and video signals are mixed in the transmitter. 3.6 Explain the scanning process. 3.7 Explain the following terms with respect to T.V. transmission: a. Visual acuity; b. Aspect ratio; c. Flicker effect.	- Distinguish between monochrome TV and colour TV - Describe various types of monochrome TV	

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		**Course Code: EEE. 435**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content			
10 - 12	3.8 Describe vestigal modulation 3.9 Explain quadrature distortion 3.10 Sketch I.F. amplifier response 3.11 Sketch a labelled complete video signal 3.12 Explain the terms: a. gamma correction b. system gamma 3.13 Describe AGC and AFC principles as applied to Television. 3.14 Explain with the aid of block diagram, the principle of a monochrome TV receiver and 3.15 Explain the function of each block 3.16 Explain how the received signal is converted into picture in the C.R.T. 3.17 Explain the functions of: a. The aquadag; b. The focus coil; c. The E.H.T		

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		**Course Code: EEE. 435**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content			
12 - 13	3.18 Describe the various types of colour television systems in use: a. NTSC; b. PAL; c. SECAM. 3.19 Describe the type of system used in Nigeria 3.20 Describe the colour television Camera system; 3.21 Explain Colorimetry and the specification of Colour (uses of primary colours). 3.22 Explain, with aid of a block diagram the principle of operation of a colour TV Transmitter. 3.23 Explain, with the aid of a block diagram, the principle of operation of a colour TV receiver. 3.24 Explain noise power with given temperature. 3.25 Derive expressions for: 1. Noise figure; 2. Minimum detectable signal 3. Maximum range. 3.26 Sketch the block diagram of a non-zero IF receiver 3.27 Explain signs of radia velocity 3.28 Sketch a block diagram to illustrate the phasing methods 3.29 List the advantages and disadvantages of the C.W. radar 3.30 Sketch a block diagram of the FM - CW radar 3.31 Solve problems on Radar communications.	- Distinguish between TV transmitter and TV receiver - Solve problem on noise figure	- Text books

PROGRAMME: HND ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course:: DIGITAL COMMUNICATIONS II		**Course Code: EEE. 435**	**Contact Hours: 1/0/3**
Course Specification: Theoretical Content			
	General Objective: 4.0 Understand the construction and principles of Telephone, Telefax and Switching systems.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
14 - 15	4.1 Describe the basic telephone system 4.2 Explain types of switching methods e.g.(Magneto, Central, Central-battery and automatic dialing) 4.3 Explain the basic system structure (exchange hierarchy) 4.4 Draw the circuit diagram of a local signalling system (principles of loop-disconnect signaling). 4.5 Explain inter-exchange signaling 4.6 Explain multi-exchange connections 4.7 Explain the principles of international calls 4.8 Describe the CCITT interface 4.8 Describe the following systems: a. Telex; b. Telefax c. Facsimile 4.10 Explain the following multiplexing systems: a. Time division multiplexing; b. Frequency division multiplexing. 4.11 Describe a multi-channel transmission system 4.12 Describe the set up of a telephone Exchange. (N.B. A visit to a telephone Exchange is necessary).		
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

EXPERIMENTS ON DIGITAL COMMUNICATION II

1.1 Experiments on Field Strength of a transmeter Parameters

1.2 Experiments on Output Stages in 1.3

1.3 Experiments on S/N, Selectivity, sensitivity of AM & FM radio receivers.

Digital Communications III (Data Communications)

General Objective:

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

1. Design simple data communicator network
2. Manage a local area Network

LIST OF PRACTICALS

WEEK

1 - 5 Simulation of a multiplexer network

6 - 8 Simulation of modem network

9 - 15 Simulation of Local area network

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DIGITAL COMMUNICATION III		**Course Code: EEE 445**	**Contact Hours: 2/0/3**
Course Specification: Theoretical Content			
	General Objective 1.0: Know the component parts, principles of operation and the application microwave systems		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1 - 5	1.1 Explain propagation through a parallel plan wave guide. 1.2 Expression for the fields E & H vectors. 1.3 Derive the formula to show the relationship between the guide wavelength and the cut-off frequency. 1.4 Describe different types of wave-guides: rectangular, elliptic, coaxial, circular, strip lines 1.5 Sketch the field and current lines in a rectangular wave-guide for the dominant mode. 1.6 Explain, with the aid of simple sketches, the principles of wave-guide components: obstacles, junctions, matched loads, attenuaters, couplers, circulators, duplexers resonant cavites. 1.7 Describe the principles of microwave tubes (klystron, traveling wavetubes (t.w.t) magnetron). 1.8 Explain some of the applications of 1.5 above. 1.9 Describe microwave semi-conductor diodes Gunn diode, Schottky diode) and transistors. 1.10 Explain the applications of items in 1.9 above. 1.11 Explain the construction and principles of operation of optic fibre systems.	Explain the importance of optical fibre in communication.	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DIGITAL COMMUNICATION III		Course Code: EEE 445	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 2.0: Know the component parts, principles of operation and application of radar systems:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
2 - 10	2.1 Define a radar system 2.2 Derive the radar equation 2.3 Explain with aid of a block diagram, the principle of operation of a radar equation 2.4 State radar frequencies 2.5 List the applications of radar system 2.6 Calculate the transmitted power 2.7 Explain with aid of diagrams, the principle of Doppler radar system 2.8 Describe various applications of radar systems 2.9 Solve problems involving radar systems using the equation in 2.2.	- Outline some examples of radar system	
	General Objective 3.0: Know the component parts, principles of operation and application of satellite communication system		
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-14	3.1 Explain with aid of diagram the principle of operation of a satellite communication system. 3.2 Describe the intesat system 3.3 Describe with aid of a diagram 3.4 Explain the term "Geo-stationary orbit" 3.5 Explain the advantages and disadvantages of a satellite system over other types of communication systems. 3.6 Explain the applications of satellite communication systems. 3.7 Solve problems on satellite communication. 3.8 Sketch a typical frequency spectrum for a satellite.	Explain passive and active satellite	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DIGITAL COMMUNICATION III		Course Code: EEE 445	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 4.0: Understand Information Technology		
Week	Specific Learning Outcome:	Teachers Activities	Resources
15	4.1 Explain the concept of information super highway. 4.2 Explain computer-telecommunications interrelationship.		
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Electronics Maintenance and Repairs

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (ELECTRONICS AND TELECOMMUNICATIONS OPTION)			
Course: ELECTRONIC MAINTENANCE AND REPAIRS		Course Code: EEE 446	Contact Hours: 0/0/4
Course Specification: Theoretical Content & Practical Content			
	General Objective 1.0: Know the use of various electrical and electronic measuring instruments		
WEEK	Specific Learning Outcome	Teachers Activities	Resources
1 - 6	1.1 Use the oscilloscope to measure voltage, current and wave-forms of an electronic circuit. 1.2 Use the oscilloscope in tracing faults in electronic circuits. 1.3 Use the signal generator to inject test signals into a given circuit, e.g. into amplifier circuit. 1.4 Use multimeters (analogue and digital) to measure such quantities as: a. voltage; b. current; c. resistance; d. out-put power; e. transistor parameters. 1.5 Use the capacitance tester to measure the value of a capacitor. 1.6 Use the transistor tester to: a. identify the terminal of a transistor; b. identify the type of transistor; c. measure the parameter/characteristics of a transistor; d. measure the forward and reverse resistance of a diode. 1.7 State the safety precautions to be taken during testing of equipment.	- Ask students to perform measurement	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: DIGITAL COMMUNICATION III		Course Code: EEE 445	Contact Hours: 2/0/3
Course Specification: Theoretical Content			
	General Objective 2.0: Know how to diagnose faults and rectify them in electronic equipment		
WEEK	Specific Learning Outcome	Teachers Activities	Resources
7 - 12	2.1 Explain the testing methods necessary to locate the following faults in electronic circuits: a. Short circuit; b. Open circuit. 2.2 Explain the testing methods necessary to locate the following faults in electronic circuits: a. Open circuit; b. Short circuit. 2.3 Diagnose open circuit, short circuit and other faults in electronic circuits and equipment using appropriate instruments. Examples of equipment are TV (black and while & colour) video sets, radio sets, tape recorders, telecommunications equipment, audio system, and computers, etc. 2.4 Rectify the faults diagnosed in 2.3 above using appropriate tools and instruments.	- Request students to perform diagnosis on some equipment	
	General Objective 3.0: Demonstrate the skill in alignment of electronic equipment		
WEEK	Specific Learning Outcome	Teachers Activities	Resources
13-15	3.1 State the various stages of the block diagram of the following: a. radio receivers b. Tv. Receivers c. Video cassette recorders d. Video camera e. Video monitors 3.2 Identify the various alignment methods for electronic equipment in 3.1 above. 3.3 Carry-out alignment on electronic equipment in 3.1	Demonstrate alignment on electronic equipment	
	ASSESSMENT: Course work 10%; Course tests 20%; Practical 20%; Examination 60%.		

Power Courses

Electrical Power Systems III

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS III		**Course Code: EEE 326**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	General Objective 1.0: Understand inter-connected systems.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1-5	On completion of this course the student should be able to:- Interconnected systems 1.1 Explain interconnected power systems. 1.2 State the advantages and disadvantages of interconnected power systems. 1.3 Explain the construction of power circle diagrams. 1.4 Explain the techniques for reducing interconnected systems to simple equivalents. 1.5 Solve problems involving 1.3 and 1.4 above. 1.6 Formulate the nodal admittance matrices of various networks. 1.7 Explain the need for load flow studies. 1.8 State load-flow problem. 1.9 Outline the variable (P; Q; V/S affecting load flow in a power system network. 1.10 Classify the variables in 1.9 into control independent and dependent variables. 1.11 Derive the general form of the load-flow equation in: i. Rectangular form; ii Polar form; 1.12 Know one method of load flow solution [ ] 1.13 Calculate load flow analysis of interconnected systems. 1.14 Explain the application of digital computers to load flow studies.	- Use demonstrative problems to assemble admittance matrix for a sample matrix. - Use network analysis to demonstrate solution of Load flow problems. - Encourage students to write simple programmes to set up an admittance matrix of a simple power system. - Demonstrate short circuit fault using a simple LC circuit. - Use problems to illustrate symmetrical and unsymmetrical faults. - Use demonstrative problems to illustrate disruptive critical voltage for an overhead line. - Use problems to show the application of the sunge velocity equation in a uniform line.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS III		**Course Code: EEE 326**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	1.15 Perform load flow analysis of interconnected systems, 1.16 Write a computer program to perform load flow analysis of a simple power network. 1.17 Execute item 1.6 in a computer.		
	General Objective 2.0: Understand the performance of fault analysis of interconnected systems.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
	2.1 Explain the various types of faults that occur on generators and transformers. 2.2 State the various types of faults that occur on transmission lines. 2.3 Explain short circuit, open circuit and earth faults on lines. 2.4 Define transient and subtransient reactances. 2.5 Explain subtransient and transient reactances using the appropriate wave form of a faulted generator. 2.6 Draw typical wave forms of short circuit currents in power systems. 2.7 Define the peak short circuit current (dynamic) using the wave form of 2.6 above. 2.8 Explain a symmetrical fault. 2.9 Solve symmetrical fault problems using line diagrams and per unit method.	- Outline the remedies for the various faults	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS III		**Course Code: EEE 326**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	2.10 Explain positive, negative and zero sequence components. 2.11 Derive expressions for the symmetrical components mentioned in 2.14 in terms of the line values. 2.12 State the expression for power in symmetrical components. 2.13 Define unsymmetrical faults (single line to ground, double line to ground, etc.) 2.14 Explain unsymmetrical fault problems using the symmetrical component networks. 2.15 Identify the sequence impedances of power system components. 2.16 Find the sequence network for a given power system. 2.17 Solve unsymmetrical fault problems using the principles of symmetrical components. 2.18 Calculate the MVA fault level on typical power systems. 2.19 Explain methods of selecting switchgear, bus-bars, fuses for typical fault levels.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS III		**Course Code: EEE 326**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	General Objective 3.0: Know the system Overvoltages and insulation requirements.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
	3.1 Explain corona and factors affecting it. 3.2 State the various effects of corona 3.3 Derive a formula for the disruptive critical voltage for an overhead line. 3.4 Explain the causes of over-voltages in power systems. 3.5 Draw a typical surge wave form. 3.6 List the possible effects of a travelling wave on a transmission system. 3.7 Derive an equation for the surge velocity in a uniform line. 3.8 Solve, using 3.7, problems on:- a. Surge velocity in a single-phase overhead line in air. b. Surge velocity in a three-phase overhead line in air. c. Surge velocity in a single-phase concentric cable	State practical applications of corona effects	
	3.9 Deduce an expression for the surge impedance (Zo). 3.10 Explain the different types of terminations. 3.11 Deduce an expression for reflected surge voltage and current, and transmitted surge voltage and current. 3.12 Define the following: a. Reflecting factor of coefficient (p) b. Transmission factor of coefficient (t) 3.13 Solve problems on surges using 3.9 and 3.11 above. 3.14 Describe the protection of transmission lines against lightning surges. 3.15 Draw graph for voltage and current surges when R is greater than Zo and Explain the graph. 3.16 Draw graphs for voltage and current surges when R is less than Zo and explain the graph.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS III		**Course Code: EEE 326**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	3.17 Explain the effect of a surge on an overhead line terminated by a transformer. 3.18 Deduce expressions for reflected voltage and current surges in an open circuited line and short-circuited line. 3.19 Solve problems involving line/cable junctions using the derived equations in 3.18 above. 3.20 Describe various types of overhead line insulators and state their uses. 3.21 Describe various methods of testing insulators. 3.22 Deduce an expression for the voltage distribution across an insulated string. 3.23 Solve problems on voltage distribution and string efficiency of insulators. 3.24 Explain insulation co-ordination in overhead lines. 3.25 Explain the operation of an impulse generator. 3.26 Explain the wave shape obtained from an impulse generator		
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

EXPERIMENTS ON ELECTRIC POWER SYSTEM III

1. Experiments on characteristics of impulse generator
2. Test insulators using various methods.

Electrical Power Systems IV

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS IV		Course Code: EEP 436	Contact Hours: 2/3
Course Specification: Theoretical Content			
	General Objective: 1.0 Understand different types of Substations and their equipment		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 Define a substation 1.2 Sketch a typical layout of a substation 1.3 Explain the following: a. Grid Substation b. Distribution substation c. Industrial substation d. Switching substation. e. Domestic substation. 1.4 State advantages and disadvantages of outdoor substations as compared to indoor substations. 1.5 List factors to be taken into consideration when deciding the siting of a substation. 1.6 Demonstrate the understanding of the following in a substation: a. Switch gears b. HRC Fuse links c. Reactors d. Lightning arrestors 1.7 Draw a single line diagram of the following systems:- a. Single bus-bar b. Sectionalised bus-bar c. Duplicate bus-bar d. Duplicate bus-bar with tie-bar reactors e. Back-to-back duplicate bus-bar with tie-bar reactors.	- Arrange a visit to a typical sub-station. - Show students typical switch gear, HRC fuses, reactors and lighting ameston. - Show students bus-bar arrangements: Sectionalised bus-bar, duplicate bus-bar, duplicate bus-bar with tie-bar reactors, bus-bar with tie-bar reactors. - Arrange a visit to the National Control center. - Show students different types of relays.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS IV		**Course Code: EEP 436**	**Contact Hours: 2/3**
Course Specification: Theoretical Content			
4 - 8	1.8 Describe the phenomena and control in electric circuit breaker 1.9 Explain the phenomena and control in circuit breakers. 1.10 Sketch the wave form of arc extinction 1.11 Explain the following: a. Restriking voltage; b. Recovery transient c. Current Chopping. 1.12 Describe Rupturing Capacity, Making Capacity, Short-time rating as applied to circuit breakers. 1.13 Describe with the aid of fully labelled diagram the operation of each of the following. a. Oil circuit breaker b. Air blast circuit breaker c. SF6 circuit breaker d. Vacuum circuit breaker e. HRC fuse f. Fused Switch g. Isolator h. Lightning Arrestors.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS IV		**Course Code: EEP 436**	**Contact Hours: 2/3**
Course Specification: Theoretical Content			
	General Objective: Understand the principle of operation of power system protection and its applications.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
9 - 12	2.1 Explain the need for a protective scheme in a power system. 2.2 State the requirements of a protective scheme namely: a. Reliability b. Discrimination c. Sensitivity d. Selectivity e. Simplicity and economy. 2.3 Explain zones of protection of a protection system highlighting the need for overlapping. 2.4 Describe the operation of the components of a protective system viz relays CTS & PTS 2.5 Classify relays as static and electro-magnetic types. 2.6 State the merits and demerits of each in 2.5 above. 2.7 Describe various types of electro-mechanical relays. 2.8 Sketch the circuit connection for a sequence filter for producing zero, positive and negative sequence components. 2.9 Analyse the circuits of 2.8 to obtain the components. 2.10 Sketch a schematic diagram of a two-input relay comperator circuit. 2.11 Derive expressions for the comparator input voltages. 2.12 Derive expressions for the operation condition of a relay comparator in:- a. Amplitude comparison mode b. Phase comparison mode. State parameter choices for obtaining the ohm, mho and impedance relay characteristics obtained in 2.13 above.	State Practical application of protective scheme	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRIC POWER SYSTEMS IV		**Course Code: EEP 436**	**Contact Hours: 2/3**
Course Specification: Theoretical Content			
13 - 15	2.13 Sketch the characteristics obtained in 2.13 above on R - X diagrams. 2.14 Explain with the aid of diagrams the following:- a. Overcurrent relay b. Distance relay c. Directional overcurrent relay, etc. 2.15 Explain differential protection. 2.16 Explain, with the aid of diagrams main protective schemes for generators, power transformers, feeders and bus-bars. 2.17 Explain inverse-time overcurrent relay. 2.18 Explain the current (plug) setting and line-setting multipliers for over current relays. 2.19 Use I.D.M.T.L. characteristics curves to solve problems relating to over current relays 2.20 Select relay settings to protect various system configurations. 2.21 Solve problems on power system protection.		
	ASSESSMENT: Course work 10%; course tests 10%; Practical 20%; Examination 60%.		

ELECTRICAL POWER IV (POWER OPTION)

GENERAL OBJECTIVES

1. Demonstrate the knowledge of understanding different types of substations and their equipment.
2. Understand the principles of operation of power system protection and its application.
3. Understand the principles and operation of power systems
4. Describe the various factors affecting power system stability

PRACTICAL/LABORATORY EXPERIMENTS VISITS(EXCURSIONS)

1. Write reports on the visits made to:
(i) power generating station
(ii) Grid substation (Oshogbo or Jebba)
(iii) Local substation/industrial substations or consumer substation

LABORATORY EXPERIMENTS

1. Experiments on characteristics impedance
2. Experiments on phase sequence operation on systems
3. Experiments on a three-phase protective devices for system symmetry
4. Experiment on NO-LOAD tap changing transformer
5. It is necessary to have Network Analyser.

Electrical Power System V

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRIC POWER SYSTEM V		Course Code: EEP 446	Contact Hours: 3 tiers lecture
Course Specification: Theoretical Content			
	General Objective 1.0 Understand the principles and operation of power system.		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	System Operation 1.1 Explain power system operation tasks viz: a. Operations planning b. Operations control c. Operations data acquisition an analysis 1.2 Explain the role of automation 1.3 List factors affection voltage and frequency of a synchronous machine 1.4 Explain governor action with relation to machine speed. 1.5 Explain the variation of voltage with change in excitation. 1.6 Explain the principles and effects of: a. Synchronous phase modifier b. Static shunt and series capacitors c. Tap-charging transformers 1.7 Sketch typical input-output curve for a thermal unit 1.8 Sketch the typical incremental heat curve for 1.9. 1.9 Reproduce an expression representing a model of the fuel cost for power generation	- Show students tag - changing a typical power transformer. - Use problems to illustrate the principle of unit commitment. - Use problems to illustrate the principle of stability (Equal Area Criteria)	
5	1.10 Explain incremental cost of power delivered by a power plant. 1.11 Derive an equation representing the equal incremental cost loading principle 1.11 Represent the principle in 1.11 graphically. 1.12 Discuss optional operation of power systems. 1.13 Explain load forecasting.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRIC POWER SYSTEM V		Course Code: EEP 446	Contact Hours: 3 tiers lecture
Course Specification: Theoretical Content			
6 - 7	15 Describe some methods of load forecasting 1.16 Explain with the aid of characteristics tie-line, and load frequency control 1.17 Determine Area Control Error (ACE) for a system		
8 - 9	1.18 State the units of ACE. 1.19 Explain supervisory control 1.20 Explain telementry 1.21 Explain with suitable diagrams, carrier communication on transmission lines 1.22 State the advantages of 1.21		
	General Objective 2.0: Know the various factors that affect poor system stability		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
10 - 11	2.1 Define power system stability 2.2 Define power limit or stability limit 2.3 Distinguish between steady state, transient and dynamic stability 2.4 State the power relation for stable operation 2.5 Establish that angular displacement between voltages necessary for the transfer of real power. 2.6 Explain the dynamics of the rotor of machine subjected to a disturbance.	- Use problems to show the application of power system stability.	
12 - 13	2.7 Derive the power angle equation 2.8 Derive the swing equation 2.9 Explain the M and H constants 2.10 Explain the swing curve 2.11 Sketch typical swing curves 2.12 Derive the power-angle equations for a machine connected to an infinite through a network represented by its ABCD parameters. 2.13 Sketch the power-angle curves for 2.12 2.14 Sketch the relative location of maximum angular shifts for input power from		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRIC POWER SYSTEM V		Course Code: EEP 446	Contact Hours: 3 tiers lecture
Course Specification: Theoretical Content			
14 - 15	2.15 Explain concepts in transient stability 2.16 Establish stable and unstable equilibrium points on a power angle curve. 2.17 Explain the equal area method for stability assessment 2.18 State the equal area criterion 2.19 Define critical clearing angle 2.19 Explain various methods of improving the stability of a system. 2.20 Solve problems on power system stability using the formulae derived in 2.7, 2.8 and 2.12		
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Electrical Maintenance and Repairs

SEMESTERS 3 AND 4

General Objectives

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

1. Know record keeping and methods of determining spare parts requirement.
2. Demonstrate ability to maintain equipment and supervise personnel
3. Know how to use and test and commission equipment.

PRACTICAL WORK

1. Carry out electrical installation work in the workshops and laboratories
2. Strip down an electrical motor, carry out some repair/routine service work.
3. Carry out cleaning exercises in the Laboratories and workshop
4. Visit some Industries for more exposure
5. Run a four-wire three phase system.

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
COURSE: ELECTRICAL MAINTENANCE AND REPAIRS		COURSE CODE: EEP 444/	CONTACT HRS: 1/3
Course Specification: Theoretical Content			
	General Objective: On completion of this course, the students should be able to:		
WEEK	Specific Learning Outcome	Teachers Activities	Resources
1 - 5	1.1 Explain the need for keeping records of tools and equipment. 1.2 Explain the need for keeping records of materials. 1.3 Explain the need to prepare ordering schedule for replenishing materials and tools used. 1.4 Explain methods of checking stock materials (pin cards, stock card, computer method etc.)	- Use practical examples to illustrate record and stock keeping	- Record and stock keeping book

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
COURSE: ELECTRICAL MAINTENANCE AND REPAIRS		COURSE CODE: EEP 444/	CONTACT HRS: 1/3
Course Specification: Theoretical Content			
	General Objective: On completion of this course, the students should be able to:		
6 - 10	2.1 Explain the need for keeping in order the instruction manuals, maintenance manual and drawings. 2.2 Explain the need to prepare maintenance schedule and programme for maintenance work. 2.3 Prepare the routine maintenance schedule. 2.4 Explain the need for proper supervision of maintenance work. 2.5 Explain the need for proper recording of maintenance work done.	- Explain by practical approach.	
11 - 15	3.1 Identify equipment for different test: a. Insulation resistance test b. Dielectric strength test c. Murray loop test for earth fault etc. 3.2 Explain the method of carrying out the required test, using equipment in 3.1 above in the following: a. Motor b. Transformer; c. Generator d. Electrical Installation e. Starters f. Appliances g. Cookers, etc. 3.3 Explain the need to observe the safety precaution when testing equipment 3.4 Give certificate of completion after tests are satisfactory. 3.5 Test items listed in 3.2 3.6 Service items listed in 3.2 3.7 Repair items listed in 3.2	- Show students the various equipment used for testing.	
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Machine Courses

Electrical Machines III

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course ELECTRICAL MACHINES III		Course Code: EEP 327	Contact Hours: 75 HOURS
Course Specification Theoretical Content			
	General Objective 1.0: Understand the fundamental principles of electrical machines.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	On completion of this course the student should be able to: Principles of electrical machines: 1.1 State the principles of induction, interaction and alignment as applied to electrical machines. 1.2 Explain with the aid of sketches how the principles are applied to electrical machines.	- State typical examples of electrical machines	
	General Objective 2.0: Understand the principles of electro-mechanical energy conversion		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
4 - 8	2.1 State the major energy conversion principles. 2.2 Derive the general energy balance equation applicable to all situations 2.3 Represent by suitable block diagrams the energy balance equation. 2.4 Derive induced voltage and electrical energy input in singly excited systems. 2.5 Derive the energy in the magnetic field of a singly excited system. 2.6 Derive the mechanical force in the system in 2.5 above. 2.7 Derive energy balance equation. 2.8 Develop the dynamic equation of singly excited electro-mechanical system. 2.9 Solve problems involving 2.2 to 2.7 above.	- Ask students to solve problems involving energy balance equation	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course ELECTRICAL MACHINES III		Course Code: EEP 327	Contact Hours: 75 HOURS
Course Specification Theoretical Content			
	General Objective 3.0: Know the principles of operation and construction of transformers		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
9 - 11	3.1 Explain the working principle of the transformer 3.2 Develop the end equation of a transformer 3.3 Describe the different types of transformer cores and windings. 3.4 Explain resultant flux, magnetising inductance, leakage fluxes and leakage inductances. 3.5 Explain the phaser diagrams for transformer on no-load and on-loaded conditions. 3.6 Explain the equivalent circuit of a transformer 3.7 Identify the limitations of the equivalent circuit and the approximate equivalent circuit. Use the open-circuit test and the short-circuit test to	- Show the physical construction of a transformer - visit NEPA substation. - Explain the different constructions of (core, shell etc.) single and three phase transformers. - Derive expression for the generated emf equation in a transformer. - Explain phasor diagram at no load and full load.	
12 - 13	3.8 Determine the equivalent circuit parameters. 3.9 Derive equations for the efficiency and voltage regulation. 3.10 Connect three single phase transformers for those phase operation (i.e. Star/Star, Star/Delta, Delta/Delta) 3.11 Show with the aid of sketches the possible arrangement of three transformer windings. 3.12 Group transformers into their vector groups. 3.13 Explain the use of each group and their advantages. 3.14 Explain the purpose of the tertiary windings in three phase transformers. 3.15 Explain the parallel operation of three phase transformers. 3.16 Derive expression for load sharing of transformers connected in parallel.	- Identify no load and short circuit conditions. - Draw the equivalent circuit diagram. - Carry out transformer load conditions. - Demonstrate the type of losses in transformers. - Derive an expression for transformer efficiency and voltage regulation..	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course ELECTRICAL MACHINES III		Course Code: EEP 327	Contact Hours: 75 HOURS
Course Specification Theoretical Content			
14 - 15	3.17 Describe methods of testing transformers namely:- a Specialised investigation on particular details of design, performance and operation after manufactory. 1. Acceptance test. 3.18 Routine test during life span of the transformer 3.19 Differentiate between power and distribution transformers. 3.20 Explain the effects of temperature rise on transformers. 3.21 Describe methods of cooling transformers 3.22 Explain the limitation of each method 3.23 Explain the source of vibration and noise in transformers 3.24 Explain voltage control by tap changing 3.25 Explain the causes of harmonies in transformers 3.26 Solve related problems involving 3.1 - 3.24.	- Demonstrate the types of winding connections. - Demonstrate the use of group connections. - Explain parallel operation of transformers Explain the basic different between power and distribution transformers. - Visit a NEPA substation for possible noise from transformers. - Explain the methods of cooling transformers. - Demonstrate the advantage of single phase and three phase transformers. - Connect three-single phase transformer to form a three phase transformer. - Solve problems in efficiency, voltage regulation, referred values, cooling systems ie temperature rise etc.	
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Laboratory Experiments: Electrical Machine III

1. Single and three phase transformer connections and characteristics of parameter.
2. Heat Run and regenerative efficiency test in two single phase transformer
3. Parallel operation of Transformers
4. Connection of three single phase transformers to form a single - three phase transformer, and characteristics of parameters.
5. Experiments on principle of electrical machines
6. Experiments on energy conversion

Electrical Machines IV

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		Course Code: EEP 439	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective 1.0: Understand all the working parts of the synchronous machines		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 List with the aid of a diagram various parts of the synchronous machines 1.2 Describe the construction of 1.1 above. 1.3 Explain the functions of the part of the synchronous machine.	- With the aid of diagrams illustrate the different parts of a synchronous machine - Visit machine laboratory. - Strip down a typical a.c. generator and show the various parts. - Explain the different between a generator (a.c.) and a synchronous machine	
	General Objective 2.0: Know the classification and connection of synchronous machines		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
2 - 3	2.1 State types of windings used for A.C. machines 2.2 Differentiate between single layer and double layer windings. 2.3 Explain pole pitch and slot pitch, coil span, concentrated winding and distributed winding. 2.4 Draw development diagrams of windings showing their connections.	- Demonstrate the type of wiring arrangement machines (single layer/ double layer types). - Explain the development diagram.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		**Course Code: EEP 439**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	General Objective 3.0: Understand the emf equation, factors affecting it and its regulation.		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
4 - 5	3.1 Derive the emf equation of the synchronous machine with concentrated winding and full pitch winding 3.2 State factors affecting induced emf. 3.3 Explain the importance of these factors. 3.4 Derive equations for distribution and coil span factors. 3.5 Modify 3.1 to suit all machines 3.6 Solve problems involving the use of equations in 3.1, 3.4 & 3.5 3.7 Explain magnetomotive force (mmf) due to distributed winding using graphical method. 3.8 Draw the mmf wave diagram of the synchronous generator. 3.9 Explain the mmf wave diagram of 3.8. 3.10 Explain armature reaction and leakage fluxes and reactances 3.11 Explain synchronous reactance and synchronous impedance. 3.12 Draw equivalent circuit of synchronous machines. 3.13 Draw phasor diagram for synchronous machine operating as a motor or generator. 3.14 Derive expression for the voltage regulation using:- a. Synchronous reactance method b. Ampere turn method.	- Show how to derive an expression for the emf generated in a synchronous (Alternator) machines. - Explain the factors affecting the emf equations. - Show how to derive expressions for distribution, chording and coil span factors. - Solve problems in 1 - 3 - Explain armature reaction in alternator. - Demonstrate synchronous impedance. - Draw the equivalent circuit diagram for alternators.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		**Course Code: EEP 439**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
6 - 7	3.15 Compare the results of the two methods in 3.14. 3.16 Identify the need for pre-determination of the regulation of a synchronous generator. 3.17 Define short circuit ratio. 3.18 Explain the effect of saturation on synchronous reactance. 3.19 Explain the Potier diagram 3.20 Explain zero power curve 3.21 Explain the effect of salient on synchronous reactance. 3.22 Draw phasor diagram for salient pole machine. 3.23 Solve problems relating to synchronous machines.		
	Experiments		
8	1.1 Determine by experiments the open and short circuit characteristics of synchronous machines. 1.2 Perform an experiment to illustrate Potier diagram and from it determine direct axis synchronous reactance. 1.3 Determination of open circuit short circuit characteristics of a synchronous machine. 1.4 Determination of load characteristics of an Alternator. 1.5 Parallel operation of synchronous machines.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		**Course Code: EEP 439**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	General Objective 4.0: Understand the performance of synchronous machine connected with electrical power system		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
9 - 10	4.1 Describe the characteristic of an infinite bus-bar 4.2 Describe the behaviour of a synchronous generator 4.3 Explain the need for the synchronization of two or more machines 4.4 State the conditions to be satisfied when connecting a machine to an infinite bur-bar. 4.5 Describe methods of synchromising machines using: a. Dark lamp method; b. Bright lamp method; c. Rotary synchroscope. 4.6 Explain current loss diagram of a synchronous machine. 4.7 Solve problems involving the current ocus of a synchronous machine 4.8 Explain V - curves diagram of a synchronous machine.	- Explain the infinite bus-bar - Explain the parallel operation of machines - Explain the V-Curves - Solve problems on V-curves.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		**Course Code: EEP 439**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
11 - 13	4.9 Solve problems involving the V - curves in 4.8 above. 4.10 Explain the effect of variation of excitation of synchronous generator connected to an infinite bus-bar. 4.11 Draw phasor diagrams to illustrate 4.10 above. 4.12 Derive equation for synchronising power and torque for: 1. Cylindrical rotor; 2. Salient pole rotor. 4.13 Draw the torque angle and power angle characteristics. 4.14 Compute loadsharing with the prime mover inputs known. 4.15 Solve problems involving the use of equation in 4.12 4.16 Draw the operating chart for synchronous machines. 4.17 Solve problems involving operating chart. 4.18 Describe method of voltage and frequency control of synchronous machine. 4.19 Explain methods of enroling synchronous generators.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY (POWER AND MACHINES OPTION)			
Course: ELECTRICAL MACHINES IV		**Course Code: EEP 439**	**Contact Hours: 75 HOURS**
Course Specification: Theoretical Content			
	General Objective 5.0: Understand the principles of operation and uses of synchronous motor		
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
14 - 15	5.1 Describe the various methods of starting a synchronous motor 5.2 Explain the operation of a synchronous motor on an Infinite Bus-bar 5.3 Explain the use of a synchronous motor for power-factor correction. 5.4 Compare a synchronous condenser with static capacitors for Power Factor Correction. 5.5 Compare the synchronous motor with other types of electric motors in practical applications. 5.6 Explain the concept of infinite Bus-bar systems.	- Explain how the production of rotating motor can be done. - Strip down an induction motor and show the parts. - Show the difference between a squirrel cage and wound rotor. - Explain the principle of an induction machine. - Show an expression synchronous speed, slip an asynchronous machine can be. - Explain the machine constants. - Draw the equivalent circuit diagrams. - Using the constants in 6 to construct the circuit diagrams. - Show how an expression for the torque can be derived. - Explain the torque/speed characteristics. - Explain various speed control in a.c machine	
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		

Electrical Machines V

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MACHINES V		Course Code: EEP 447	Contact Hours: 1/2
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the principle and application of d.c motor speed control		
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 5	1.1 Explain the following modes of d.c motor speed control. a. Armature voltage control b. Field current control 1.2 Explain with the aid of diagram the Ward-Leonard system of speed control. 1.3 List solid state converters used to supply d.c motors as: a. Choppers (d.c to a.c converter) b. Rectifier (a.c to d.c converter) 1.4 List the methods to obtain reversed power flow in converter motor arrangement. 1.5 Explain with the aid of diagrams the following methods of braking d.c. shunt and series motors: a. Generative b. Dynamic c. Plugging 1.6 Solve problems involving 1.1 to 1.5 above.	State typical applications of converter	

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: ELECTRICAL MACHINES V		Course Code: EEP 447	Contact Hours: 1/2
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the operation and application of a.c commutator machines		
Week	Specific Learning Outcome:	Teachers Activities	Resources
6 - 10	2.1 Explain how the frequency at the brush and of coil rotating in a constant magnetic field. 2.2 Explain how the frequency at the brushes and of coil current very with the rotation of the poles around a stationary rotor. 2.3 Explain the effect on the brush voltage frequency of connecting through slip ring a.c current to rotor winding which at the same time is connected to a commulator. 2.4 Draw winding arrangement for charge motor. 2.5 List the limitation of the above motor. 2.6 Draw winding arrangement of the universal motor 2.7 Explain the production of the driving torque of the universal 2.8 List the limitation of this motor		
	General Objective 3.0: Understand and apply special drives for industrial utilization:		
Week	Specific Learning Outcome:	Teachers Activities	Resources
11 - 15	3.1 List four applications of d.c motors as industrial drives. 3.2 Define Group and Individual drive 3.3 State the limitation of Group drives 3.4 List the advantages of Group drives 3.5 Explain factors used in the selection of motors as: Electrical characteristics i. Starting characteristic ii Running characteristic iii. Speed control iv Breaking Mechanical characteristics a. Structural features i.e type of enclosure or bearing b. Method employed in the transmission of power c. Noise	- State examples of motor and their rating	

	d. Type of cooling Size and Rating of Motors: a. Rating of motors b. Suitability of the motor for continuous intermittent loading. c. Overload capacity. Cost a. Initial cost b. Running cost. 3.6 State the assumptions used in the calculation of temperature rise. 3.7 Derive formula for temperature rise in a machine. 3.8 Define heating Time Constant 3.9 Derive expression for cooling of machines 3.10 Draw heating curve and cooling curve 3.11 State the requirement of electric tranction motors 3.12 Calculate the speed-time relation temperature rise of traction 3.13 Explain the scheme of controlling traction motors 3.14 Solve problems involving selection of drives 3.15 Determine by experiment the rise in temperature in an electrical machine 3.16 Determine by experiment the heating and cooling curves of an electrical machine		
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

Laboratory Experiment

1. Determine by experiment the various speeds of a d.c. motor using Ward-Leonard system
2. Determine by experiment the characteristics of s speed control system.
3. Determine by experiment the various speed of an a.c commutator.
4. Determine by experiment the torque/speed characteristics of charge motor
5. Determine by experiments the speed controls of a.c and d.c motors using thyristors.

Instrumentation Courses

Electrical Measurement and Control III

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: EE1 311, ELECTRICAL MEASUREMENT AND CONTROL III		Course Code: EEI 311	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective 1.0: Know temperature Measuring System		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Define Units of Temperature e.g. Kelvin, Fareinheit, Absolute Centigrade etc. 1.2 Covert from one Unit of temperature to another. 1.3 Identify temperature measuring systems e.g. filled system, thermocouples, resistance, themometry, Thermiostors, bimetalic, pyrometers, Quarts Crystal. 1.4 Classify the different types of the temperature measuring systems. 1.5 Explain the Principles of Operation and the Constructional features of each type. 1.6 State the advantages and disadvantages of each system. 1.7 Calibrate temperature measuring devices such as thermometers, thermocouples etc. using standard calibrating equipment e.g. Sandbatch, Oilbath etc. 1.8 Install temperature measuring devices using the correct technique.	- Use various types of Thermometers to measure Temperature - Demonstrate different ways of calibrating Thermometers. - Identify various pressure measuring Devices. - Perform measurement of pressure using some of the Devices. - Show how to calibrate pressure Devices using Dead Weight Tester, pneumatic pressure test pump etc.	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: EE1 311, ELECTRICAL MEASUREMENT AND CONTROL III		Course Code: EEI 311	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the techniques of pressure measurement		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
4 - 6	2.1 Define the limits of measurement of Pressure e.g. Pascal. 2.2 Convert from one Pressure Unit to the other. 2.3 Define pressure as force/Unit area. 2.4 Define the following terms used in pressure measurements - atmospheric, guage, absolute, differential, vacuum pressures. 2.5 Identify and explain the principle of operation of the different methods of Pressure Measurement, e.g. Manometric methods, Bellows, electronic, Bourdon, High Pressure, Diaphragm, Chemical etc. 2.6 Select and use measuring Instruments, 2.7 State the advantages and disadvantages of each measuring Instruments. 2.8 Identify and use Calibrating devices. 2.9 Calibrate Pressure measuring devices, Observing safety precautions. 2.10 Explain the Constructional features and operational Principles of Pressure measuring devices and Calibrating devices. 2.11 Instal service and maintain pressure measuring devices. 2.12 Explain methods of installation of measuring instruments. 2.13 Dismantle and assemble pressure measuring instruments.	- Use flow Devices. - Identify differential pressure meters, eg. Orofice plate, Venturo Tube Nozzle etc. - Identify Different types of Level measuring Instruments. - Identify Safety devices - Demonstrate the use of various types of Analyzers. - Identify various components of a time measuring devices, such as stop-Watch, Chronographs, Chronometers	

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: EE1 311, ELECTRICAL MEASUREMENT AND CONTROL III		Course Code: EEI 311	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective 3.0: Know flow measurement		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
7 - 8	3.1 Define Units of flow measurement e.g. Cubic litre/hour etc. 3.2 Explain the types of flow e.g. Laminar, turblent etc. 3.3 Differentiate between compressible and non-compressible fluids. 3.4 State Compressibility factor. 3.5 Explain Reynolds number 3.6 Explain Viscosity 3.7 State and explain Bernoulli Theorem 3.8 Derive Bernoulli equation 3.9 Select and use flow measuring devices 3.10 Measure fluid flow in closed Pipes using differential mressure meters, e.g. Orifice plate, Venture - tube, Dal tube flow Rozzles etc.		
9 - 10	3.11 Explain the operational Principles and Constructional features of the flow DP measuring devices mentioned above. 3.12 Name and explain the constructional features and the operational Principles of different types of Orifice plates e.g. P-type, HP-types, Concentric sharp edge, Thin plate, quardrantedged, integral etc. 3.13 Select and Instal different types of Orifice Plates. 3.14 State the units, advantages and disadvantages of the above named types of Orifice plates. 3.15 Employ the following tapping methods e.g. D+D tappin, Flange tapping, corner tapping etc. for Orifice plate installations. 3.16 Define impulse lines. 3.17 Explain the following terms - castports cooling chambers, flangers and flange ratings. 3.18 State Units of measurement in actual Volume, reduced volume weight unit.		

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Course Specification: Theoretical Content			
11	3.19 State HP ratio 3.20 State formula for hot liquids near boiling point (h) (p-p) 3.21 State and explain Reynolds number 3.22 State Velocity of approach factor and Co-efficient of discharge - (R = dve/3) 3.23 Carry out Orifice plate Sizing, using the following parameters: diameter ratio (d/D) Reynolds number, J - Value etc. Explain the constructional features and the operational Principles of the following flow meters - Rotameters, Magnetic, Turbine Positive displacement, Doppler etc. 3.24 Select, instal and maintain the above flow meters. 3.25 State the areas of application, the advantages and disadvantages of each of the above named flow meters. 3.26 Explain the Constructional features and the Principles of Operation of the Weirs and Parshall Flumes flow meters. 3.27 Apply Weirs and Parshall Flumes meters in measurement of fluids in open channels.		
	General Objective 4.0: Understand level measurement and apply it in vessel		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
12 - 13	4.1 State the Units of level measurement e.g. Metre, feet etc. 4.2 Name different types of level measuring instruments Flort, displacement, capacitance, ultrasonic, radiation, DP, diaphrgm level guages etc. 4.3 Explain the Principles of operation of the level measuring instruments named above. 4.4 Explain the Constructional Features of Level measuring devices. 4.5 State the advantages and disadvantages of the level measuring devices. 4.6 Select and instal service and maintain level measuring devices. 4.7 Explain the application of level measuring devices in Open and Closed Vessels.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: EE1 311, ELECTRICAL MEASUREMENT AND CONTROL III		Course Code: EEI 311	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective 5.0: Know instrumentation Symbols		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
14 - 15	5.1 Identify and draw instrumentation Symbols 5.2 Write Instrumentation and control abbreviations 5.3 Use tag numbers to identify component parts of a control system 5.4 Identify loop drawings in the Piping and Instrument diagrams by using symbols and tag numbers 5.5 Translate sequences of operation from logic Circuit diagram to electrical circuit diagram.		
	ASSESSMENT: Course work 10%; Course tests 10%; Practical 20%; Examination 60%.		
	General Objective 6.0: Understand the safety Precaution necessary during Installation & maintenance of instrument and control devices.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
15	6.1 State the safety devices necessary for the installation or instrument and control devices, Pressure relief Values, Rupture, Discs, Flame arrestor, Flammable detector.		
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

EXPERIMENTS: ELECTRICAL MEASUREMENT & CONTROL III

1. Experiments on Instruments calibrations
2. Carry out Orifice plate sizing
3. Identify loop drawings in the piping and Instrument
4. Dismantle and assemble pressure measuring instruments
5. Install, service and maintain pressure measuring Instruments
6. Use ammeter, voltmeter and power factor meter to measure three-phase Load
7. Calibrate temperature measuring devices such as thermometers and thermocouples.
8. Measure Fluid flow in closed pipes.

Electrical Measurement and Control IV

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: 314: ELECTRICAL MEASUREMENT & INSTRUMENTATION IV		Course Code: EEI 431	Contact Hours: 1/2
Course Specification:			
	General Objective 1.0: Know the methods of locating faults in cables		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 2	1.1 Explain methods of measuring earth resistance. 1.2 Describe the following methods of localising short - circuit and open-circuit faults, on cables: a. Blaniers test; b. Murray-loop test; c. Varley-loop test, etc. 1.3 Solve problems on each of the tests, in 1.2 above. 1.4 Explain the practical application of each of the tests in 1.2 above 1.5 Carry out practical tests using the methods of 1.2 above. 1.6 Determine by experiment the earth resistance of various electrical items (circuit, appliances, etc.)	- Show the students various types of transducers. - Measure the resistance of various metals by different methods. - Show the students how to avoid the effect of parallax in measuring instruments. - Show the student a cable both in and out of circuits. - Demonstrate the effect of I^2R loss on cables by holding a current carrying cable.	
	General Objective 2.0: Understand the principles of operation of various types of transducers		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
3 - 4	2.1 Define a transducer 2.2 Explain the various types of electrical transducers 2.3 Outline the various types of electrical transducers a. Resistive type; b. Capacitive type; c. Inductive type; 2.4 Explain the operation of various potentiometric type transducers: a. Linear potentiometric type; b. Angular potentiometric type; 2.5 Explain transfer function of 2.4 above, assuming all energy storage terms are zero. 2.6 Describe a strain gauge (Resistance element) transducer		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: 314: ELECTRICAL MEASUREMENT & INSTRUMENTATION IV		Course Code: EEI 431	Contact Hours: 1/2
Course Specification:			
5 - 6	2.7 Calculate Poisson's ratio (h) and strain sensitivity of a strain gauge. 2.8 Explain the expression for the gauge factor in terms of the Poisson's ratio. 2.9 State the difference between a bonded and unbounded type of strain gauge.. 2.10 Explain the principle of operation of a thermistor.. 2.11 Explain the principles of operation of a thermocouple. 2.12 Explain the thermocouple laws.		
7- 8	2.13 Expatiate on the following industrial thermocouples and explain their applications. a. Copper Vs constantan; b. Chrome Vs constantan; c. Iron Vs constantan; d. Nickel/Chromium Vs Nickel/Aluminium; e. 13% Platinum Rhodium Alloy Vs Pure Platinium; f. Tungsten Vs Tungsten Rhodium etc. 2.14 Determine by experiments the parameters of the following bridge circuits:- a. Strain gauge bridges; b. Thermistor bridges; c. Thermocouple bridges. 2.15 Explain the characteristics of a variable capacitive type transducer e.g. parallel plate capacitive transducer.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: 314: ELECTRICAL MEASUREMENT & INSTRUMENTATION IV		Course Code: EEI 431	Contact Hours: 1/2
Course Specification:			
9 - 10	2.16 Explain the sensibility of a parallel plate capacitive transducer when:- a. The separation (t) is varied; b. The cross-sectional area (a) is varied; c. The dielectric constant (k) is varied. 2.17 Measure various physical quantities using capacitive transducers e.g. a. Liquid level measurement; b. Displacement measurement; c. Thickness measurement; d. Composition measurement 2.18 Describe the various types of inductive type transducers e.g.:- a. Variable Inductance (L) or Reluctance (R.M.) b. Differential Inductance; c. Differential transformer		
11	2.19 Explain the operation of:- a. Linear Variable Differential Transformer (LVDT); b. Tachometer. 2.20 Explain areas of application of the transducers discussed above. 2.21 Demonstrate practically the applications of items in 2.21 above.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: 314: ELECTRICAL MEASUREMENT & INSTRUMENTATION IV		Course Code: EEI 431	Contact Hours: 1/2
Course Specification:			
	General Objective 3.0: Understand the principles of operation and application of recorders.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
12	3.1 List different types of recorders 3.2 Explain the principles of operation of the following recorders:- a. Graphic b. Strip chart c. Galvanometer type d. Null-potentiometer type e. Bride type f. Linear-Variable Differential transformer (LVDT) type X- Y g. Oscilloscope recorders h. Digital recorders. 3.3 Demonstrate practically the use of recorders in 3.2 above.		
	General Objective 4.0: Understand the principle of operation and application of digital and electronic instruments		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13 - 14	4.1 Explain with the aid of block diagrams the principle of operation and application of electronic voltmeters a. D.C. Voltmeter with direct-coupled amplifier b. D.C. Volymeter with chopper-type amplifier. 4.2 Describe the construction and operation of AC voltmeters using operational ampliers, rectifiers etc. 4.3 Explain with a block diagram the construction and operation of a differential voltmeter. 4.4 Describe with the aid of a block diagram the construction and operation of Digital voltmeters: a. Ramp-type b. Stair case - ramp type.		

PROGRAMME: HND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: 314: ELECTRICAL MEASUREMENT & INSTRUMENTATION IV		Course Code: EEI 431	Contact Hours: 1/2
Course Specification:			
15	4.5 Calibrate by experiments various digital voltmeters. 4.6 Explain the principle of operation and application of the following: a. Wave analyser b. Harmonic distortion analyser c. Spectrum analyser d. Q-meter. 4.7 Demonstrate practically the applications of items in 4.6 above. 4.8 Explain the measurement methods and errors using Q-meter.		
	ASSESSMENT: Course work 10%; Course test 10%; practical 20%; Examination 60%.		

EXPERIMENTS: MEASUREMENT & INSTRUMENTATION IV

1. Experiments on earth resistance measurement of various electrical items
2. Experiments on characteristics of transducers in 2.3 to 2.9
3. Experiments on coefficient of resistance
4. Experiments on transducers e.g. Thermocouples, LVDT and Tachogonerator
5. Locate simulated fault in Cable
6. Construct Thermocouple and test it.
7. Calibrate recorders.

Instrumentation Design and Drafting

GENERAL OBJECTIVE:

At the completion of the programme the students should be able to:

1. Identify and draw standard Instrumentation symbols
2. Perform manual drafting
3. Draft with Software packages
4. Interpret process diagrams
5. Install and Commission Instruments
6. Design Instrumentation System.

LIST OF PRACTICALS

WEEK

1 - 2	Manual Drawing of instrument symbols
3 - 4	Introduction to software packages
5 - 9	Design Instrumentation System for a mini plant
10 - 14	Use Software packages to produce piping and Instruments diagram.

ASSESSMENT: Course work 10%; Course test 10%; Practical 40%; Examination 40%.

Pneumatic Instrumentation

Course Objective:

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

1. Explain the operation of pneumatic Instrument.
2. Calculate and set the gains of pneumatic Controller
3. Install pneumatic Instruments
4. Calibrate pneumatic Instruments.

LIST OF PRACTICALS

WEEK

1 - 2	Install and dismantle a flapper/nozzle system. (Teachers should show example).
2 - 3	Install and dismantle pneumatic transmitters.
4 - 6	Set the gains of pneumatic Controller. Perform experiment with PID Controller. Install and dismantle pneumatic Controllers. Students should Perform Calibrate Pneumatic Controller.
7 - 8	Install and dismantle Pneumatic recorders. Calibrate pneumatic recorders.
9 - 10	Connect Copper pipe from transmitter to a recorder. Vary the Signal from 3 - 15psi. Compare the recorded values with transmitted values.
11 - 13	Install and Calibrate a Control valve. Discouple and recouple a Control Valve.

ASSESSMENT: Course work 10%; Course tests 10%; Practical 40%; Examination 40%.

Electronic Instrumentation

General Objective

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

1. Select and apply transducers
2. Design and construct signal conditioning equipment
3. Design, Construct, Install and Calibrate analogue controllers
4. Install and use PLC in process automation
5. Use Computer as a Controller
6. Install and maintain analytical Instruments.

LIST OF PRACTICALS

WEEK

1 - 2	Design and Construct a simple potentiometric transducer.
2 - 4	Design, Construct and use capacitance bridge with capacitance transducer to measure process variable.
5 - 7	Design, construct and test a P+ I analogue Controller
8 - 10	Write and test Programmes in PLC
11 - 13	Write and test Control program in BASIC Language.
14	Install analytical Instruments.

ASSESSMENT: Course work 10%; Course tests 10%; Practical 40%; Examination 40%.

Instruments Repairs and Maintenance

General Objectives:

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

1. Observe Instruments Safety
2. Know Performance Objectives
3. Know Maintenance Management
4. Know Workshop Management
5. Know equipment Standards

LIST OF PRACTICALS

WEEK

1 - 2	Students should carry out Survey of the Workshop and write report on tools, equipment and general condition of the workshop.
3 - 10	Students should troubleshoot and repair faulty instruments. The faults could be simulated by Instructor.
11 - 14	Students should trace faults simulator on the instrument panels.

ASSESSMENT: Course work 10%; Course tests 10%; Practical 40%; Examination 40%.

Process Measurement

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: PROCESS MEASUREMENT		Course Code: EEI 444	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
	General Objective. Students should be able to measure process variables		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 5	1.1 List Units of Pressure measurements a. Pascal; b. Bar c. kN/m^2 d. psi, e. kgf/cm^2 1.2 Convert from one pressure unit to another. 1.3 Define the following terms used in pressure measurement: a. gauge b. absolute c. atmospheric d. vacuum e. differential, etc. 1.4 Explain the manometric methods of pressure measurements. 1.5 Explain the operation of elastic pressure measurement devices a. Diaphragm b. Bellows c. Bourdon 1.6 Explain the operation of Semiconductor diaphragm 1.7 Explain the operation of Capacitance manometer. 1.8 Explain the operation and the use of dead weight tester.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: PROCESS MEASUREMENT		Course Code: EEI 444	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
6 - 8	2.1 State the units of flow measurements a. m^3/s b. kg/s. 2.2 State and explain Reynolds number 2.3 Explain the types of flow a. Laminar b. Turbulent, etc. 2.4 State the formula of Compressibility factor. 2.5 Explain Compressibility factor 2.6 State Bernoulli's equation 2.7 Derive the equation for flow rate 2.8 State the differential pressure elements such as a. Orifice b. Venturi c. Dall tube d. Flow nuzzle etc.		
8 - 10	2.9 Sketch and explain the operation of the devices in 2.8 above. 2.10 Explain in detail the construction Orifice plates. 2.11 State the advantages and disadvantages of the elements in (2.6) above. 2.12 State the Standard tappings a. D + D/2 b. Flange c. Side 2.13 Explain castport cooling chamber 2.14 Explain the principles of operation of the following meters: a. Turbine b. Rotameter c. Magnetic d. Positive displacement etc. 2.15 Explain the operation of Open Channel flow meters 2.16 Calculate flow rate across a.d.p. element.		

PROGRAMME: HND ELECTRICAL/ELECTRONICS TECHNOLOGY			
Course: PROCESS MEASUREMENT		Course Code: EEI 444	Contact Hours: 75 HOURS
Course Specification: Theoretical Content			
10-12	3.1 Define temperature as rate of Molecular activities. 3.2 State the Unit of temperature measurements i. °C, ii °F, iii. K iv R 3.3 Convert from one unit to another 3.4 State the Physical condition which 0°C or 0°F represent. 3.5 Classify temperature measurement into electrical and non-electrical methods. 3.6 Explain the operation of liquid filled thermometers. 3.7 Explain the operation of gas and Vapour filled thermometers. 3.8 Explain the operation of elastic material thermometers. (Bimetallic Strip) 3.9 Explain the operation the following electrical thermometers: a. thermocouples b. resistance c. thermistors d. Quartz crystal e. Pyrometer 3.10 Use thermocouple tables to calculate measure temperature.		
13 - 15	4.1 State the units of level measurement a. Metre b. Feet 4.2 List level measurement devices a. Float b. Displacer c. Capacitance d. Radiation e. Ultra-Sonic f. Diaphragm level gauges. 4.3 Explain the operation of the devices listed in 4.2 above. 4.4 State the advantage and disadvantages of the devices listed in 4.2 above. 4.5 State the applications of the devices listed in 4.2 above.		
	ASSESSMENT: Course work 10%; Course test 10%; Practical 20%; Examination 60%.		

PROCESS MEASUREMENTS EEI 444

General Objectives:

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

1. Measure the major process variables
2. Install Process measurement Instrument
3. Calibrate process measurement instruments.

Course Specification LIST OF PRACTICALS CONTACT HOURS: 75 HOURS			
	General Objective.		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1. Measure low pressure with U-tube Manometer 2. Measure high pressure with Bourdon gauge 3. Calibrate pressure gauges with dead weight tester. 4. Install and dismantle pressure gauges. 5. Measure pressure with potentionmetic transducer.		
5 - 9	1. Measure flow through an orifice place 2. Measure flow rate with rotameter 3. Install and dismantle Differential pressure meters 4. Install an dismantle positive displacement meters 5. Calibrate flow meters.		
10 - 12	1. Constant K type thermocouple and use it for temperature measurements. 2. Install and dismantle temperature gauges. 3. Calibrate temperature gauges.		
13 - 14	1. Construct and measure level with float assembly 2. Measure level with displacers.		

Mathematical Courses

Advanced Algebra

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		Course Code: MTH 311	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 1.0: Understand hyperbolic, exponential and logarithmic functions		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
1- 2	**Functions:** 1.1 Define hyperbolic sine and cosine functions in terms of exponential functions 1.2 Draw the hyperbolic graphs for sine, cosine, tangent 1.3 Transform hyperbolic to trigonometrical functions, and vice - versa 1.4 Evaluate universal trigonometric logarithmic functions 1.5 Review logarithmic functions 1.6 Solve problems involving 1.4 above e.g evaluate $\tan^{-1}$____- $\tan^{-1}$_____	• The teacher to illustrate with good examples and make notes where necessary • Ask the students: - to define hyperbolic sine and cosine functions in terms of exponential functions and draw the hyperbolic graphs for sine, cosine, tangent - to transform hyperbolic to trigonomentrical functions, and vice-versa - to evaluate universal trigonometrical functions and solve problems relating to it. e.g $\tan^{-1}$____- $\tan^{-1}$_____ • Assess the students	Recommended textbook, chalkboard, chalk, lecture notes etc.

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		Course Code: MTH 311	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 2.0: Understand power, Maclaurin and Taylor series with application to logarithmic trigonometric and hyperbolic functions		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
4 - 5	2.1 State the power series of the form (1+n) 2.2 Evaluate power series in 2.1 above 2.3 Test for the convergence/divergence of the series in 2.2 above 2.4 Apply Taylor's formula 2.5 Derive Macclaurin series from Taylor's formula 2.6 Expand functions of the form cos x, sin x tanh x, e^x Evaluate functions like sin 31° e^x Text for the convergency/divergency of the series from 2.3 to 2.6 above 2.7 Test for absolute convergency of the series from 2.3 to 2.6 above 2.8 State the ¼ Hospital rule 2.9 Apply ¼ Hospital's rule to solve the problems in determinants 2.10 Apply ¼ Hospital's rule to trigonometric and logarithmic series.	• Ask the students: - to state the power series of the form (1+n) and also evaluate it. - to test for the convergence/divergence of the series - to apply Taylor's formula and derive Macclaurin series from Taylor's formula - to expand functions of the form cosx, sinx, tanhx, e^x and evaluate functions like sin 31°, e^x - to test for absolute convergency of the series evaluate above - to state the ¼ Hospital's rule and apply it to solve problems in determinants, trigonometric and logarithmic series • Assess the students	Chalk, blackboard, Lecture note

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		Course Code: MTH 311	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 3.0: Understand the principle of mathematical Induction		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
7 - 8	3.1 Establish the truth theorem for specific value 3.2 Explain for some fixed integer, n, the truth theorem 3.3 Explain the truth theorem for an integral value (n+1) 3.4 Explain the application of mathematical induction on Arithmetic progression $\sum^{n} r$ 3.5 Geometric progression $\sum^{n} r^{z}$	• Ask the student to: - establish the truth theorem for specific value, and explain for some fixed integer n, the truth theorem - ask the students to explain the truth theorem for an integral value (n+1) - explain the application of mathematical induction on Arithmetic progression or Geometric progression $\sum^{n} r^{z}$ • Assess the students	

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		Course Code: MTH 311	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 4.0: Understand the principles of matrices as applied to engineering problems		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
9 - 10	4.1 Define types of matrices, null square, rectangular row 4.2 From matrices from sets of linear equations 4.3 Perform the Arithmetic operations in matrices. Addition, subtraction, etc. 4.4 Obtain the transpose, adjunct, co-factors and the inverse of a matrix 4.5 Describe the use of matrix method to linear simultaneous equation 4.6 Define the Eigen-vector and Eigen-value for a set of matrices 4.7 Perform the partitioning method for very large matrices 4.8 Apply matrices to engineering problems	• Ask the students to: - define types of matrices- null, square, rectangular, row and form matrices from sets of linear equations - perform Arithmetic operations in matrices for example: if $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 3 & 0 \\ 1 & 2 & 5 \end{bmatrix}$ Find (i) A + B, (ii) A - B - Use good examples to illustrate the transpose, adjunct co-factors and inverse of a matrix - Assess the students - Explain how to use matrix to solve linear simultaneous equations. And ask the students to solve some examples - Explain eigenvector and eigenvalue for set of matrices	Recommended Textbook, chalkboard, and notes

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		**Course Code: MTH 311**	**Contact Hours 2HRS/WK**
Course Specification: Theoretical Content			
		Assess the students Compute AB, given $A = \begin{bmatrix} 2 & 1 & 0 \\ 3 & 2 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 2 & 3 & 1 & 2 \end{bmatrix}$ by partitioning. Illustrate how matrices are applied in engineering problem. - Assess the students	
	General Objective 5.0: Understand the principle of vector Algebra		
WEEK	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
12 - 13	5.1 Add, subtract and multiply vectors 5.2 State the divergence theorem 5.3 Explain surface integrals as volume integrals 5.4 Stocke's theorem 5.5 Evaluate certain integrals using stocke's 5.6 Explain vector integration, and vector differential gradient and divergence	- Explain to the students with good examples and make notes where necessary - Ask the students to: 4. carry out the addition, subtraction and multiplication of vectors 5. to state divergence and stoke's theorems 6. evaluate certain integrals using stocke's formula 7. explain surface integrals as volume integrals 8. explain vector integration, and vector differential gradient and divergence and apply the analysis to engineering problems. • Assess the students.	Recommended textbook, chalkboard, lecture notes

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: ADVANCED ALGEBRA		Course Code: MTH 311	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 6.0: Understand the concept and application of complex numbers		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
14 - 15	6.1 Explain complex number 6.2 Explain rectangular and polar forms of complex number 6.3 Explain the addition and subtraction of complex numbers 6.4 Explain the multiplication and division of complex numbers 6.5 Compute modules and argument of complex numbers e.g → = 3+4i; Find Z→/Z/ 6.6 Define a complex number using Argand's diagram 6.7 Add and subtract two samples number using Argand diagram 6.8 State De Moiver's theorem for an integer (positive and negative) 6.9 Apply De Moiver's theorem to A.C theory 6.10 Solve equations involving two more complex numbers e.g solve the following equation for the real numbers x and y: (3 + 4í) 2 - 2 (n + íy) = n + íy 6.11 Explain rationalization of complex numbers	• The teacher to explain to the students with good examples and make notes where necessary • Ask the students to: 4. perform the addition, subtraction, multiplication and division of complex numbers 5. to compute modules and argument of complex numbers e.g Z = 3 + 4í 6. Find /Z/, Arg.Z 7. define complex number using argands's diagram • Assess the students	Recommended textbooks, Chalkboard, Lecture Note

Advanced Calculus

Course: ADVANCED CALCULUS	Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content		
	General Objective 1.0: Understand Laplace transform	
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 Define Laplace transform 1.2 Obtain Laplace transform of simple functions 1.3 Define the inverse Laplace transform 1.4 Obtain the inverse Laplace transform of simple functions 1.5 Evaluate some partial fractions with: (i) linear denominator (ii) quadratic 1.6 Express the derivative in laplace transform 1.7 Express unit step, impulse Driac delta and ramp functions in laplace transform 1.8 Apply laplace transform to differential equation e.g solve by laplace transform the boundary - value problem $\partial u = 4\partial^2 u \; \partial t \; \partial \; x^2$ u(O,t) = 0, u(3,t) = O u(x, O) = 10 sin 2 x - 6 sin 4 x 1.9 Apply Laplace transform to suitable engineering problems e.g use Laplace transform to find the charge and current at anytime in a series circuit having an inductance L, capacitance C, Resistance R, emf E, assume charge and current are zero	• the teacher to illustrate with good examples and make notes where necessary • Ask the students to: - define Laplace transform and apply in simple functions - evaluate some partial fractions as indicated in 1.5 and express the derivative in laplace transform. • Assess the students	Recommended textbook, chalkboard, chalk, lecture notes, etc

Course: ADVANCED CALCULUS		Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content			
	General Objective 2.0: Understand Fourier series and apply it to solve engineering problems		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
5	2.1 Define Fourier series 2.2 Explain the periodic function 2.3 Explain the non-periodic function 2.4 Identify even and odd functions 2.5 Explain even and odd functions using graphical representation 2.6 Explain the characteristics of even and odd functions 2.7 Derive the Fourier coefficients in both polar and rectangular forms	• The teacher to illustrate with good examples - and make notes where necessary. • Ask the students to: - define Fourier series, explain the periodic and non periodic functions, identify even and odd functions and explain them using graphical representation • Assess the students. • Ask the students to derive the Fourier coefficients in both the polar and rectangular forms • Assess the students.	
6	2.8 Expand simple functions in Fourier series e.g (i) simple linear algebraic functions (ii) trigonometric and logarithmic functions 2.9 Derive the Fourier series for a trigonometric function using the half range approach 2.10 Expand functions with arbitrary period 2.11 State the Euler's formula 2.12 Establish a complex Fourier series 2.13 Evaluate the integration of Fourier series 2.14 Apply Fourier series to suitable engineering problems	• Ask the students to: - expand simple functions in Fourier series as indicated in 2.8 - derive Fourier series for trigonometric functions using the half range approach, and expand functions with arbitrary period - state Euler's formula and establish a complex Fourier series - evaluate the integration of Fourier series and apply fourier series to solve engineering problems • Assess the students.	Recommended textbooks, Chalkboard, Chalk, Lecture note, etc.

Course: ADVANCED CALCULUS	Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content		
	General Objective 3.0: Understand the method of solving second order differential equations	
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
5 - 7	3.1 Identify a homogeneous linear equation of the second order 3.2 Establish the second order differential equation with constant coefficients viz: $\frac{a(d^2y)}{dx^2}+\frac{b(dy)}{dx}+Cy=O$ 3.3 Find the real and distinct, equal and complex roots for 3.2 above 3.4 Solve the fundamental system of general solution, given intial values 3.5 State Caudiy's equation	The teacher to illustrate with good examples and make notes where necessary Ask the students to: establish 2nd Order D.E with constant coefficients viz: $\frac{a(d^2y)}{dx^2}+\frac{b(dy)}{dx}+Cy=O$ and find the real and distinct, equal and complex roots for the equation above. solve the fundamental system of general solution, given initial values and also to state Caudiy's equation. Assess the students	
8 - 10	3.6 Explain the existence and uniqueness of solutions to 2nd Order differential equations problems 3.7 Explain the homogeneous linear equations of higher order constant coefficients 3.8 Solve non-homogeneous differential equations 3.9 Solve simple simultaneous differential equations	Ask the students to: - explain the existence and uniqueness of solutions to 2nd Order differential equations problems and homogeneous linear equations of higher order constant coefficients - solve many problems on non-homogeneous differential equations, and simple simultaneous differential equations Assess the students	

Course: ADVANCED CALCULUS		Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content			
	General Objective 4.0: Understand methods of solving simultaneous linear differential equations		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
11	4.1 Explain linear differential equation 4.2 Identify special cases of solving first - order differential equations 4.3 Apply the method of exact equations, separable variable to solve differential equation problems 4.4 Apply knowledge of linear differential equation to suitable engineering problems	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - explain linear differential equation and identify special cases of solving first-order differential equations - apply the equation, separable variable to solve differential equation problems and apply it in suitable engineering problems • Assess the students	-Do-
	General Objective 5.0: Understand the methods of solving partial differential equations and their uses		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
12	5.1 State partial differential equation of order 2 5.2 Solve partial differential equation using "variable separable" 5.3 Apply D' Alembert's solution of the wave equation to partial differential equation problems 5.4 Apply the Laplacian concept in polar coordinates to partial differential equation problems	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - state 2nd - order partial differential equation and solve many problems on it using "variable separable" method - apply D'Alembert's solution of the wave equation and Laplacian concept in polar coordinates to partial differential equation problems • Assess the students	

Course: ADVANCED CALCULUS	Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content		
	General Objective 6.0: Understand the principles of functions of several variables and their uses	
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13 - 14	6.1 Explain limits and continuity of given functions 6.2 Explain mean-value theorem using total differentials 6.3 State Taylor's formula for functions of several variables 6.4 Derive maxima and minima of functions of several variables including possible saddle points 6.5 Establish the constrained maxima functions of several variables 6.6 Define a line integral in a plane 6.7 Explain the path of integral 6.8 Evaluate line integral problems 6.9 Define the green's theorem in a plane 6.10 Apply green's theorem to solve line integral problems	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - explain limits, continuity of given functions, and mean value theorem using total differentials. - State Taylor's formula, derive maxima and minima of functions of several variables including possible saddue points - Establish the constrained maxima functions of several variables, define a line integral in a plane and explain the path of integral • Assess the students	

Course: ADVANCED CALCULUS	Course Code: MTH 312	Contact Hours 2/0/0
Course Specification: Theoretical Content		
	General Objective 6.0: Understand the principles of functions of several variables and their uses	
15	6.11 Apply double integral to line integrals 6.12 Apply change of variables in triple integrals 6.13 Evaluate the differentiation under the integral sign 6.14 State stoke formula 6.15 Apply stoke formula to line integrals in space 6.16 Apply stoke's formula to suitable engineering problems	• Ask the students to: - evaluate line integral problems - define green's theorem in a plane and apply it to solve line integral problems - apply double integral to line integral and change of variable in triple integrals - evaluate differentiation under the integral sign, state stokes formula and apply it to line integrals in space - how stoke's formula is applied to solve engineering problems • Assess the students
		Recommended textbooks, chalkboard, chalk, lecture notes etc.

Statistical Methods

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: NUMERICAL METHODS		Course Code: MTH 313	Contact Hours 2 HRS/WEEK
Course Specification: Theoretical Content			
	General Objective 1.0: understand the use of numerical methods to solve linear and non-linear equations		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Find solution of linear algebraic equation using Guass elimination method 1.2 Solve linear algebraic equations using Guass-seidel iteration methods 1.3 Apply Newton-Raphson iteration formulae to non-linear equations e.g. find the roots of the equation Cosx = x^2 as accurately as your tables permit. Find the square root seriat of log x^2-5	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - linear algebraic equation using gauss-seidel-elimination and iteration methods - apply Newton-Raphson iteration formulae to non linear equations, as indicated in 1.3	Recommended textbooks, chalkboard, chalk lecturer notes etc
	General Objective 2.0: Understand finite Differences		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
2 - 3	2.1 Define finite differences 2.2 Explain the forward differencing tabulation 2.3 Explain the building of errors in a difference table 2.4 Explain the backward difference table 2.5 Explain the central difference formula 2.6 Apply the forward, backward and central difference formula or tables in solving related practical problems	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - define finite differences and explain the forward differencing tabulation - explain the build-up of errors in a difference table, and backward difference table, and central difference formula - apply the forward, backward, and central difference formula or tables in solving related practical problems • Assess the students	Recommended textbooks, chalkboard, chalk lecturer notes etc

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: NUMERICAL METHODS		Course Code: MTH 313	Contact Hours 2 HRS/WEEK
Course Specification: Theoretical Content			
	General Objective 3.0: Understand interpolation as applied to difference table		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
4 - 5	3.1 Define the Newton-gregory forward difference interpolation formula 3.2 Evaluate the difference table with unequal interval using divided differences 3.3 State lagrange's interpolation formula 3.4 Evaluate a table using largange interpolation formula	• The teacher to illustrate with good examples and make notes were necessary • Ask the students to: - define the Newton-gregory forward difference interpolation formula and evaluate the difference table with inequal interval using divided differences - state lagrange's interpolation formula, and evaluate a table using it	Recommended textbooks, chalkboard, chalk lecturer notes etc
	General Objective 4.0: Understand Numerical Differentiation		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
6 - 7	4.1 Explain the basic process of numerical differentiation up to the third derivative 4.2 Explain differentiation based on equal interval interpolation formula 4.3 Evaluate higher order derivatives	• The teacher to illustrate with good examples and make notes were necessary • Ask the students to: - explain basic process of numerical differentiation up to the theird derivative. The explanation must be based on equal interval interpolation on formula - evaluate higher order derivatives • Assess the students	Recommended textbooks, chalkboard, chalk lecturer notes etc

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: NUMERICAL METHODS		Course Code: MTH 313	Contact Hours 2 HRS/WEEK
Course Specification: Theoretical Content			
	General Objective 5.0: Understand Numerical Integration		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
8 - 9	5.1 explain the Traapezoidal and Simpson's rules 5.2 evaluate an integral using the three-sights rule	• The teacher to illustrate with good examples and make notes were necessary • Ask the students to explain the Trapezoidal and Simpson's rules and also to evaluate an integral using the three sights rule	Recommended textbooks, chalkboard, chalk lecturer notes etc
	General Objective 6.0: Understand numerical methods of solving first and second order ordinary differential equation		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
10 - 15	6.1 Explain Runge-Kutta's and Euler's methods 6.2 Solve the first order ordinary differential equation, using Runge-Kutta's method e.g if dy = 2x + y, y(0) = 1, find the approximate value of y, using (a) Euler's and (b) Runger-Kutta's methods 6.3 Solve the second order ordinary differential equation using Rung-Kutta's method	• The teacher to illustrate with good examples and make notes were necessary • Ask the students to: - explain Runge-Kutta's and Euler's methods and use it to solve 1st order differential equation of the form - dy = 2x +y, y(0)=1 - solve many problems on 2nd order ordinary differential equation using Rung-Kutta's method	Recommended textbooks, chalkboard, chalk lecturer notes etc

Statistical Methods in Engineering

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: STATISTICAL METHODS IN ENGINEERING		Course Code: MTH 413	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective: 1.0 Understand the basic concept of probability distributions and same in solving engineering problems		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Define a Binomial distribution 1.2 Explain the characteristics of Binomial distribution 1.3 Apply Binomial distribution to samples with replacement 1.4 Apply Binomial distribution to solve engineering problems 1.5 Define the Normal Distribution 1.6 Explain the characteristics of normal distribution 1.7 Describe normal distribution curve and the empirical rule	• The teacher to illustrate with good examples and make notes where necessary • Ask the students to: - define Binomial distribution, explain its characteristics and apply it to samples with replacement, and to solve engineering problems. - Define normal distribution, explain its characteristics and describe normal distribution curve and the empirical rule • Assess the students	Recommended textbooks, chalkboard, chalk lecturer notes etc

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: STATISTICAL METHODS IN ENGINEERING		**Course Code: MTH 413**	**Contact Hours 2HRS/WK**
Course Specification: Theoretical Content			
4 - 7	1.8 Calculate probability given the mean and the standard deviation 1.9 Calculate the deviation Z given the mean, standard deviation, and a particular observation 1.10 Calculate the area under the curve at different points from either side of the mean 1.11 Apply normal distribution curve to simple engineering problems 1.12 Define Poisson's distribution 1.13 Explain the characteristics of Poisson distribution 1.14 Explain the quality control techniques in production process 1.15 Explain acceptance sampling as applied to mass production 1.16 Test for equality of means of given population using t-test 1.17 Test for equality of variances using the F-test 1.18 Apply the chi-square test in statistical quality control	• Ask the students to: - calculate probability given the mean and standard deviation - calculate the deviation Z given the mean, standard deviation, and a particular observation - calculate the area under the curve at different points from either side of the mean and also apply normal distribution curve to simple engineering problems • Assess the students • Ask the students to: - define Poisson distribution, explain it characteristics, and explain the quality control techniques in production process - explain acceptance sampling as applied to mass production - test for equality of means of given population and equality of variances using t-test and f-test respectively - apply the chi-square test in statistical quality control • Assess the students	

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: STATISTICAL METHODS IN ENGINEERING		Course Code: MTH 413	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 2.0: Understand the principle of reliability		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
8 - 12	2.1 Distinguish between validity and reliability 2.2 List types of reliability testing 2.3 State the procedures for determining test-retest reliability 2.4 Apply test - retest reliability to samples 2.5 State the procedures for determining split half reliability 2.6 Determine the reliability coefficient 2.7 Determine the acceptance level of reliability 2.8 Determine the standard error of measurement $\int\varepsilon_m = \frac{\int\delta}{\sqrt{(1-r)}} \quad \frac{\int\delta}{\sqrt{(1-r)}}$ where SD = standard deviation r = error SE_M = standard error	• Ask the students to: - distinguish between validity and reliability and list types of reliability testing - state the procedures for determining test-retest reliability and apply it to samples - state the procedures for determining split half reliability, determine the reliability coefficient and acceptance level of reliability • Assess the students - Ask the students to determine the standard error of measurement, using the following expression $\int\varepsilon_m = \frac{\int\delta}{\sqrt{(1-r)}} \quad \frac{\int\delta}{\sqrt{(1-r)}}$ where SD = standard deviation r = error SE_M = standard error • Assess the students	Recommended textbooks, chalkboard, chalk lecturer notes etc

PROGRAMME: HND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: STATISTICAL METHODS IN ENGINEERING		Course Code: MTH 413	Contact Hours 2HRS/WK
Course Specification: Theoretical Content			
	General Objective 3.0: Understand Basic statistical experimental designs		
WEEK	Specific Learning Outcome:	Teachers Activities	Resources
13 - 15	3.1 Describe various experimental designs e.g complete randomized block design, randomized complete block design, split squares, Graeco Latin squares 3.2 List examples of when any of 3.1 above can be used 3.3 Enumerate the advantages and disadvantages of using the various designs in 3.1 above	• Ask the students to: - describe various experimental designs as indicated in 3.1 and list examples of when any of the designs can be used - enumerate the advantages and disadvantages of using the various designs indicated in 3.1 above Assess the students	Recommended textbooks, chalkboard, chalk lecturer notes etc

General Studies Courses

Industrial Management

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General objective 1.0: Comprehend private and state control of enterprises		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
1	1.1 Identify types of enterprises: sole proprietor, limited liability, co-operative societies, public corporation, partnership. 1.2 Explain the objectives of a business organization. 1.3 Explain the business environment (e.g political, economic etc) 1.4 Examine private enterprises 1.5 Evaluate the public enterprise 1.6 Appraise the effect of private control of business. 1.7 Analyse the implications of state control of enterprises.	- Treatment of 1.1 should include the structure, functions, advantages and disadvantages of each type of business organization.	
	General Objective 2.0: Understand the methods of management		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
2 - 3	2.1 Define management 2.2 Explain the functions of management planning, organizing, controlling, staffing, directing. 2.3 Explain the purpose of managing money, men, material and machines. 2.4 Examine the concept of authority and responsibility. 2.5 Appraise management by objectives. 2.6 Analyse the roles of the Chief Executive and Board in policy formulation and implementation. 2.7 Explain motivation. 2.8 Explain the concepts of Theory X and Y 2.9 Evaluate management control 2.10 Examine problems of leadership in organization.		

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 3.0: Know elements of marketing		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
4	3.1 Define "marketing" and "market" 3.2 State the marketing mix-product, price, place, promotion. 3.3 Explain product differentiation. 3.4 Explain market segmentation. 3.5 Differentiate the industrial market from the consumer market.		
5	3.6 Define a product. 3.7 Identify the stages of the product life cycle - introductory, growth, maturity, decline. 3.8 State the features of each stage in (3.7) above. 3.9 Describe the different ways a company can develop a new product - e.g improving existing products, seeking new products from external sources, inventing a new product. 3.10 Identify the different channels of distribution of a product. 3.11 Choose the most appropriate channel of distribution for a given product. 3.12 State the features of each channel in (3.11) above.		

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General objective 4.0: Understand Personnel Development		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
6 - 7	4.1 Explain the concept of personnel management 4.2 Define recruitment 4.3 Explain the selection and engagement procedures. 4.4 Appraise evaluation and merit rating. 4.5 Explain the importance of education, training and development. 4.6 Explain following: skill training, attitude training, technical training, management training. 4.7 Examine the relevance of industrial training to productivity in an organization. 4.8 Examine critically different types of conditions of service. 4.9 Define trade unionism, collective bargaining, joint consultation, conciliation, arbitration. 4.10 Explain the roles of the Industrial Arbitration Panel, the Industrial Court and the Ministry of Labour in maintaining industrial harmony in Nigeria. 4.11 Explain labour's share in the organisation's income.		

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 5.0: Comprehend Quantitative Management Techniques		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
8	5.1 Identify types of management decisions 5.2 Explain the modern quantitative decisions techniques. 5.3 Appraise operation research. 5.4 Apply the use of decision trees, diagrams, programme evaluation review techniques (PERT), critical path model, etc in operation research. 5.5 Examine the structure of linear programming problems. 5.6 Chart some linear programming problems. 5.7 Examine the simplex method in solving linear programming problems.		
	General Objective 6.0: Understand maintenance schedules and replacement strategies		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
9	6.1 Explain purchasing 6.2 Analyse storage and stock ordering 6.3 Calculate the economic order quantity (EOQ) 6.4 State the importance of production in an organization 6.5 Evaluate production planning and control. 6.6 Appraise production scheduling 6.7 Explain quality control 6.8 Analyse replacement strategies 6.9 Define the following terms; preventive planned, corrective, breakdown, running and shutdown as used in maintenance 6.10 Critically examine maintenance culture in Nigeria. 6.11 Estimate depreciation and scrap value.		

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 7.0: Understand money and the financial institutions		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
10	7.1 Define money 7.2 Explain the functions of money 7.3 Explain the functions of the Central Bank 7.4 Analyse the functions of a commercial bank. 7.5 Explain the functions of other financial institutions: the Merchant Bank, Mortgage Bank, Insurance Organisation, etc. 7.6 Enumerate types of insurance policy - e.g life policy, fire, marine, etc.		
	General Objective 8.0: Appreciate Investment management		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
	8.1 Define investment 8.2 Explain investment objectives and decisions 8.3 Explain methods of investment forecast, e.g payback period, internal rate of return, net present value, etc.		
11- 13	8.4 Critically examine the company's finance e.g cash, balance sheet, income statement, budgetary control, cash flow 8.5 Analyse project planning. 8.6 Explain risk and uncertainty in a project. 8.7 Explain project evaluation. 8.8 Analyse types of business costs e.g fixed cost, variable cost and total cost. 8.9 Analyse contract costing. 8.10 Explain the break-even point 8.11 Calculate the break-even point 8.12 Chart the break-even.		

PROGRAMME: GENERAL STUDIES			
Course: Industrial Management		Course Code: GNS 413	Contact Hours: 2/0/0
Course Specification: Theoretical Content			
	General Objective 9.0: Understand data management		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
14	9.1 Explain the purpose of report writing 9.2 Explain the importance of literature review 9.3 Examine methods of data collection 9.4 Explain data measurement 9.5 Apply the use of tables and graphs in data presentation. 9.6 Examine methods of data interpretation. 9.7 Evaluate oral presentation of information.		
	General Objective 10.0: Understand the industry and national economy		
WEEK	Specific Learning Outcomes	Teacher Activities	Resources
15	10.1 State the importance of industry to human development. 10.2 List the factors necessary for the location of an industry. 10.3 Explain the main features of Nigeria's industrial policy. 10.4 Explain the different types of economic systems 10.5 State the importance of the national income 10.6 Examine the national economy.		

Business Entrepreneurship

PROGRAMME: HIGER NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: ENTREPRENEURSHIP DEVELOPMENT I		Course Code: SDV 210	Contact Hours: 3Hours/WK
Course Specification: Theoretical Content			
	General Objective: 1.0 Comprehend Private and state control of enterprise		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
1 - 5	1.1 Identify types of enterprises, sole proprietor, limited liability, co-operative societies, public corporation, partnership 1.2 Explain the objective of a business organisation 1.3 Explain the business environment (e.g. political, economics e.t.c.) 1.4 Examine private enterprises 1.5 Evaluate the public enterprise 1.6 Appraise the effect of private control of business 1.7 Analyse the implications of state control of enterprises NOTE:- Treatment of 1.1 should include the structure, functions, Advantages and disadvantages of each type of business Organisation	- Ask the students to identify types of enterprises, sole proprietor, limited liability, co-operative societies, public corporation, partnership - Ask the students to explain the objective of a business organization - Ask the students to explain the business environment (e.g. political, economics e.t.c) - Ask the students to examine private enterprises - Ask the students to evaluate the public enterprise - Ask the students to appraise the effect of private control of business - Ask the students to analyse the implications of state control of enterprises	- Chalk - Blackboard

PROGRAMME: HIGER NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: ENTREPRENEURSHIP DEVELOPMENT I		Course Code: SDV 210	Contact Hours: 3Hours/WK
Course Specification: Theoretical Content			
	General Objective: 2.0 Understand the methods of management		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
6 - 10	2.1 Define management 2.2 Explain the functions of management planning, organizing, Controlling, staffing, directing 2.3 Explain the Purpose of managing money, men, material and machines 2.4 Examine the concept of authority and responsibility 2.5 Appraise management by objectives	- Ask the students to define management - Ask the students to explain the function of management planning, organizing, controlling, staffing, and directing. - Ask the students to explain the purpose of managing money, men, material and business - Ask the students to examine the concept of authority and responsibility - Ask the students to appraise management by objective	- Chalk - Blackboard
	2.6 Analyse the roles of the chief Executive and Board in policy Formulation and implementation. 2.7 Explain motivation 2.8 Explain the concepts of theory X and Y 2.9 Evaluate the management control 2.10 Examine problems of leadership in organization	- Ask the students to analyse the roles of the Chief Executive and Board in policy formulation and implementation - Ask the students to explain motivation - Ask the students to explain the concepts X and Y - Ask the students to evaluate the management control - Ask the students to examine problems of leadership in organization	Chalk Blackboard

PROGRAMME: HIGER NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: ENTREPRENEURSHIP DEVELOPMENT I		Course Code: SDV 210	Contact Hours: 3Hours/WK
Course Specification: Theoretical Content			
	General Objective 3.0: Know elements of marketing		
WEEK	Specific Learning Outcome:	Teacher Activities	Resources
11 - 15	3.1 Define "marketing " and market" 3.2 State the marketing mix-product, price, place, promotion 3.3 Explain product differentiation 3.4 Explain the market segmentation 3.5 Differentiates the industrial market from the consumer market 3.6 Define a Product 3.7 Identify the stages of product life cycle-introductory, growth, maturity, decline 3.8 State the features of each stage in (3.7) above 3.9 Describe the different ways a company can develop a new product-e.g. improving the existing products, seeking new products from existing source inventing a new product	- Ask the students to define "Marketing " and Market - Ask the students to state the marketing mix-product, price, place, and promotion. - Ask the students to explain product differentiation - Ask the students to explain market segmentation - Ask the students to differentiate industrial market from the consumer market - Ask the students to define a product - Ask the students to identify the stages of product lifecycle-introductory, growth, maturity, decline - Ask the students to states the features of each stage in (3.7) above	- Chalk - Blackboard

List of Minimum Resources

COMPUTER TECHNOLOGY LABORATORIES

Additional facilities required for the computer technology option.

The following experimental logic modules are recommended.

Section A:

Introduction to Digital Circuits with the following experimental modules.

1. The logic checker/logic probes
2. The waveform or clock generation circuits
3. The pull-up circuit
4. The pull-down circuit
5. The push button switch module
6. The inverter circuit and their use in driving LEDs
7. The high/low signal display module
8. The numerical display Module using 7-segment display
9. Binary to 7-segment conversion module
10. Semi-conductor switch module
11. Digital counter circuit module

12 Binary to decimal conversion logic module

13 Debouncing circuits

14 Hexadecimal to binary conversion module

15 The latch module

16 One pulse generating circuits and power-up one-shorts

17 Flip-flops and registers

18 Presettable counter circuits

19 Adder circuits

20 Subtractor circuits

21 Combinatorial logic circuit components to facilitate Turth-Table NAND, NOR, EX-OR¸EX-NOR

22 An assortment of TTL, TTL/S C-MOS, P-MOS¸& ECL logic Ics to facilitate students design and Implementation of registers, modulus counters and pattern generators.

Computer Maintenance workshop

LAB/WORKSHOP EQUIPMENT

1.	Working mini computer	1
2.	Microcomputers (5 disused & 3 working)	8
3.	Models of vital areas of the mainframe computer system and peripherals e.g.:	
i.	Tape read/write heads	2
ii.	Erase head	2
iii.	Write head	2
iv.	Read head	2
4.	Disk drive head and carriage assembly	3
5.	Disk packs	10
6.	Disk drive machines	1
7.	Printers	2
8.	Plotters	1 old
9.	Tape reels	5
10.	Computer motor	variety
11.	Scanners	
12.	Digitizel	

DIGITAL SYSTEMS AND MICROPROCESSORS LABORATORY REQUIREMENTS

1. Structured Logic Devices: An assortment of:

a. 1-out of 2 multiplexers

b. 1-out of 4 multiplexers

c. 1-out of 8 multiplexers

d. 1-out of 16 multiplexers

e. 1-to-2 line decoder/demultiplier

f. 2-to-4 line decoder/demultiplier

g. 3-to-8 line decoder/demultiplier

h. 4-to-16 line decoder/demultiplier

2. An assortment of Erasable and Re-programmable Read Only Memories of different memory storage capacities.

3. An assortment of Field Programmable Logic Arrays (FPLAs) to facilitate use in experiments.

4. An assortment of Photo-electric devices: photo-transistors, diacs, photo-thyristors, slotted opto-couples, source/sensor pairs.

Interface modules for practical as follows:

5.	Melody module	2
6.	Amplifier module	3
7.	Speaker module	3
8.	Optical switch module	3
9.	Relay module	2
10.	Piezoelectric buzzer module	2
11.	The symbol display module	2
12.	The sound module	2
13.	Variable width one-shot pulse module	1
14.	The DC motor module	1
15.	The AC motor module	1
16.	The stepper motor module	1
17.	Temperature sensor module	2
18.	The digital comparator module	2
19.	Analogue comparator module	1
20.	Digital to Analog converter module	2
21.	Analog to digital converter module	1
22.	Digital thermometer module	1
23.	Music synthesizer module	1
24.	Digital revolution counter	1
25.	Digital clock module	1
26.	One-clip microcomputer digital temperature Controller	1
27.	Bare-board (not enclosed) microcomputer trainer kits	3
28.	Wire wrap guns	3
29.	Wire wrap boards	3
30.	Hand tools: cutters, pliers, wire strippers, assorted screw-drivers, etc.	
31.	An assortment of edge connectors	
32.	Soldering stations	1

TOOLS

1.	Logic pulser	5
2.	Logic probe	5
3.	Logic clips	5
4.	Volt-Ohmmeter	5
5.	Digital voltmeter	5
6.	Oscilloscopes	5
7.	Current tracers	-
8.	Logic analysers	5 (various models)
9.	Diskette aligners	2

MEASUREMENT AND INSTRUMENTATION WORKSHOP

(Control & Instrumentation Option Only)

1.	Electric Furnace for Temperature Instrument	1 set
2.	Adjustable drawing table	1 set
3.	Oil Bath	1 set
4.	Oven	1 set
5.	Oscilloscope	2 sets
6.	Portable Digital Multimeter	1 set
7.	Digital Thermometer	1 set
8.	Digital Thermometer (type 2804 or equivalent)	1 set
9.	Digital Manometer	4 sets
10.	D. C. Power Supplies	2 sets
11.	Electronic Universal Counter	1 set
12.	Digital LCR Meter	2 sets
13.	Function Generator	1 set
14.	Wheatstone Bridge	1 set
15.	Cold Junction Boxes	2 sets
16.	PH meter checker	1 set
17.	Conductivity meter with cell	1 set
18.	Slide Resistors	7 sets
19.	Direct reading clip on current mete.	2 sets
20.	Circuit tester	3 sets
21.	Slidacs model SD-2620S (variacs)	2 sets

22.	Slidacs model SD-2610S	2 sets
23.	Slidacs model SD-1320S	2 sets
24.	Slidacs model SD-135S	2 sets
25.	Slidacs model SD-135S	2 sets
26.	Portable Tachometer Generator	6 sets
27.	Vibration detector	1 set
28.	Megger	1 set
29.	manual Optical Radiation Pyrometer	1 set
30.	Portable circuit tester (multimeters)	20 sets
31.	Universal Battery Charger	2 sets
32.	Vacuum Pressure guage tester	1 set
33.	Dead weight tester	1 set
34.	Pnuematic pressure test pump	2 sets
35.	Vernier calipers	4 sets
36.	Outside calipers	4 sets
37.	Inside calipers	4 sets
38.	Inside micrometers	6 sets
39.	External micrometers	6 sets
40.	Platform beam scale with weights	1 set
41.	Scoop type beam scale	1 set
42.	Thermometers 0 - 100oC	15 sets
43.	Standard mercury thermometer set	15 sets
44.	Stop watches	4 sets
45.	Time limited hand tachometers	4 sets
46.	Stainless steel measuring tapes	2 sets
47.	Stainless steel compass	2 sets
48.	Stainless steel rules	4 sets
49.	Thickness gauges set	4 sets
50.	Automatic rewind and lock tape rules	2 sets
51.	Precision levels	1 set
52.	Aneroid barometer	1 set
53.	Plunger pump for pressure test	1 set
54.	Han pump for pressure test	3 sets
55.	Buffer tank for pressure test pump	1 set

56.	Bakery compressor	2 sets
57.	Carriers (carts) 600kg	2 sets
58.	Pump for control value leakage test	1 set
59.	Carriers (carts) 800kg	2 sets
60.	V blocks with clamp	2 sets
61.	Portable Electric drills	2 sets
62.	Portable Electric grinders	3 sets
63.	Bench type drilling machine	1 set
64.	Bench type grinder with mounting frame	2 sets
65.	Straight shank drills	48 sets
66.	Drill stand for drill	4 sets
67.	Machinist bench vices	3 sets
68.	Pipe vice with legs	3 sets
69.	Pin vises	3 sets
70.	Metal reel with cable	3 sets
71.	Steel wire ropes	4 sets
72.	Hemp ropes	2 sets
73.	Nylon ropes	2 sets
74.	Vinyl hose	100 meters
75.	Ladder slide type	1 set
76.	Ladder step type	1 set
77.	Lever grease injectors	3 sets
78.	½ inch square drive socket wrench sets	20 sets
79.	½ inch square drive preset type torque wrenches	7 sets
80.	Pipe wrenches	10 sets
81.	Adjustable spanner	12 sets
82.	Non sparking pipe wrenches	8 sets
83.	Non sparking adjustable wrenches	3 sets
84.	Hand type dice & wrench sets 180mm size	3 sets
85.	Hand type dice & wrench sets W size	3 sets
86.	Hand type dice & wrench sets UNF size	3 sets
87.	T handle wrenches with ratchet 5mm	3 sets
88.	T handle wrenches with ratchet 6mm	3 sets
89.	T handle wrenches with ratchet 9mm	3 sets

90.	Pipe taps dice and wrench sets NPT	3 sets
91.	Hexagon wrench key sets mm	10 sets
92.	Hexagon wrench key sets inch	5 sets
93.	12-points double offset box wrenches	27 sets
94.	T type wrench sets	20 sets
95.	Y type wrench sets	20 sets
96.	Open ended spanners	33 sets
97.	Ring shock spanner	15 sets
98.	Combination slip joint pliers	10 sets
99.	Heavy duty pump pliers	5 sets
100.	Insulated long nose pliers with slide cutter	5 sets
101.	Insulated side cutting pliers 200mm	5 sets
102.	Side cutting pliers 200mm	4 sets
103.	Terminal climping tools	4 sets
104.	Insulated combination wire stripping nippers	5 sets
105.	Diagonal cutters	5 sets
106.	Wire strippers kits with blades	5 sets
107.	Impact type screw drivers (190mm)	5 sets
108.	Impact type screw drivers (240mm)	5 sets
109.	Box drivers	60 sets
110.	Miniature precision screw drivers	10 sets
111.	General purpose screw drivers	10 sets
112.	Stubby drivers (+) & (-)	20 sets
113.	Insulated screw drivers (+) & (-)	40 sets
114.	Screw drivers (non sparking tool) (+) * (-)	36 sets
115.	Pipe cutter for copper tube	20 sets
116.	Gasket cutters	2 sets
117.	Glass cutter	1 set
118.	Scissors	5 sets
119.	Tinners scissors	5 sets
120.	Hacksaw frames with 30 blades	3 sets
121.	Holes saws	20 sets
122.	Pipe cutter for steel pipe	1 set
123.	Hi duty tube cutters (with spare wheel)	2 sets

124.	Cold chisels	8 sets
125.	Concrete hand chisels	4 sets
126.	Cold chisels (non sparking) 20 x 200	4 sets
127.	Cold chisels (non sparking) 27 x 200	4 sets
128.	Chisels for woodwork (small)	2 sets
129.	Chisels for woodwork (large)	2 sets
130.	Centre punch sets	10 sets
131.	Number figure punches set	5 sets
132.	Letter punch sets	5 sets
133.	Machinist hammers with handle 450kg	3 sets
134.	Machinist hammers with handle 675kg	3 sets
135.	Machinist hammers with hand 900kg	3 sets
136.	Plastic head mamers 20mm	1 set
137.	Plastic head hammers 35mm	1 set
138.	Plastic head hammers 50mm	1 set
139.	Needle file sets	5 sets
140.	Machinist files	10 sets
141.	Wood hammers	5 sets
142.	Hammers with handle non sparking	16 sets
143.	Machinist files (smooth)	10 sets
144.	Small bench anvils	2 sets
145.	Gasoline torches	2 sets
146.	Oil stones fine	1 set
147.	Oil stones coarse	1 set
148.	Oil stones medium	1 set
149.	Pipe benders	3 sets
150.	½ inch square drive deep sockets	8 sets
151.	Oster type die stock with ratche	2 sets
152.	Super fine set of needle files	10 sets
153.	Wooden file handles	10 sets
154.	Electric soldering iron with vacuum pump	2 sets
155.	Taper pin reamer sets	2 sets
156.	Reburring reamers for vinyl pipe	
157.	1/8" - 11/4"	2 sets

158.	½" - 2"	2 sets
159.	Washing pans	10 sets
160.	Universal pulling & lifting machine	2 sets
161.	Spar geared chain hoists (2.5m)	2 sets
162.	Spar geared chain hoists (3m)	2 sets
163.	Hand magnets with switch	5 sets
164.	Screw shackles	10 sets
165.	Hydraulic oil jacks	2 sets
166.	Flaring tools for copper with case	2 sets
167.	Universal fibre scope	1 set
168.	Transformer 230/100-115-120 V lKVA	20 sets
169.	C-Type screw clamps	2 sets
170.	Vises for drilling machine	2 sets
171.	½" square drive rachet socket handles	5 sets
172.	Cotton gloves	8 sets
173.	Rubber gloves	8 sets
174.	Leather gloves	8 sets
175.	Goggle with adjustable head band	20 sets
176.	Automatic rewind and lock tape rules	20 sets
177.	Insulated screw driver sets	20 sets
178.	Knives for Electricians	20 sets
179.	Adjustable wrenches (20mm)	20 sets
180.	Insulated side cutting pliers	20 sets
181.	Insulated long nose pliers with side cutter	20 sets
182.	Insulated combination wire stripping nippers	20 sets
183.	Tweezers	20 sets
184.	Rosin core solder for electronic/electric components	20 sets
185.	Electric soldering iron sets with vacuum pump	20 sets
186.	Hexagon wrench key sets	20 sets
187.	Steel tool boxes	20 sets
188.	Heavy duty pump pliers	20 sets
189.	Pipe wrenches	20 sets
190.	Overhead stand	9 sets
191.	New clamp	14 sets

192.	Steel spanner	32 sets
193.	Check meter for D.P. cell	3 sets
194.	Air connection set	10 sets
195.	Manometer	2 sets
196.	Mechanical tool set	10 sets
197.	Electrical tool set	10 sets
198.	Series service kit	10 sets
199.	Tool set	10 sets
200.	Control relay calibration tool	2 sets
201.	Standby manual control station	5 sets
202.	Circlip pliers/snap ring pliers	10 sets
203.	Vacuum blower	2 sets
204.	Gear-puller	2 sets
205.	D.P. Cell	Assorted
206.	Used Instrument (Assorted)	
207.	Used generators (Assorted)	
208.	Compound gauges	Assorted
209.	Coil winding equipment	
210.	Selective level meter	5 sets
211.	Digital phase meters	10 sets
212.	Used power transformers	Assorted
213.	Training stand for level	4
214.	Training stand for pressure control	4
215.	Training stand for rate & flow	2

List of Books (ND & HND)

Recommended List of Books for Electronics:

1. Operational Amplifiers - G.B. Clayton
2. Advance Industrial Electronics - Morris
3. Digital Integrated Electronics - Taub & Schilling
4. Integrated Electronics - Millman - Halkias
5. Introduction to Switching Theory and Logical Design - F.J. Hill, G.R. Peterson
6. Introduction to Digital Computer Technology - Mashelsky
7. Systematic Analogue Computer Programme - Charleswor Fletcher.

Radar and Wave

1. Radar Detection and Tracking System - S. A. Hovanessian
2. Introduction to Radar System - Skoluik
3. Foundation of Microwave Engineering - Collin
4. Microwave Transmission - J. A. Staniforth

Communication Engineering

1. Transmission Systems - M. T. Hills, B.G. Evans
2. Telecommunication - Brown & Glazier
3. Electronics & Radio Engineering - Terman
4. Electronics Communication System - Kennedy
5. Principles of Communication System - Taub & Schilling
6. Radio & Line TX A & B - D. C. Green
7. Principles of Digital Communication G. J. - Marshall
8. Signal Processing, Modulation and Noise - Betts.
9. Electrical Communication - Meadow
10. Signals, Antena, Wave Transmission, Noise, Modulation - F. R. Connors.

Recommended List of Books for Circuit Theory

1. Circuit Devices and Systems - Smith
2. Telecommunication Principles for final students 1 & 2 - Knight
3. Advanced Electrical Engineering - Morton
4. Problems in Electrical Circuit Theory - R. G. Meadows
5. Network Analysis and Synthesis - KUO
6. Higher Electrical Engineering - Shepherd, Morton, Spence.
7. Networks - By F.R. Connor
8. Circuit Theory - Vol. 1 & 2
9. Electrical Technology - E. Hughes.

Electrical Machines

1. Electrical Machinery - Fritzgerald and Kuo
2. Electrical Machines - Drapper
3. Alternating Current Machine - M. G. Say
4. Direct Current Machine - M.G. Say and E. O. Taylor
5. Introduction to Electrical Machines - Daniel
6. Electrical Technology (ND only) - Hughes
7. Higher Electrical Engineering by Shepherd, Morton, Spence

Electrical Power Engineering

1. Electric Power Systems (Third Ed.) - B. M. Weedy
2. Electrical Power Systems, Vols. I & II - A. E. Guile & W. Paterson
3. Electric Power Transmission and Distribution - P. J. Freeman
4. Generation, Transmission and Utilization of Electrical Energy - A. T. Starr
5. Transmission and Distribution of Electrical Power - H. T. Cotton
6. Elements of Power System Analysis (4^{th} Ed) - William T. Stephenson
7. Electric Power System: Design and Analysis - Mohammed El-Hawary
8. Electrical Power System: Wadhwa CL
9. Electric Energy Systems Theory: an introduction - Elgend O. I.
10. Elements of Power Systems - O. I. Elgend

Electric Field Theory (HND)

1. The electromagnetic Field in its Engineering Aspects - Carter. G. W. (Longmans)
2. Introductory Engineering Electromagnetic - Popovic
3. Applied Electromagnetic

Control Engineering (HND)

1. Control System Engineering - Magrath, L. J. & Copal, M., Viley Eastern Ltd., New Delhi, 1st Ed. 1975.
2. Control Engineering - Morris, N. M., Mc-Graw Hill, 3rd Ed., U. K.
3. Feedback Control Theory for Engineers - Atkinson, P., Heinemann, 2nd Ed., 1972
4. Theory and Problems of Feedback Control System - (Schaum's Outline Series), Di Stefeno J.J., Stubberud, A.R.,
5. William, L. J., McGraw-Hill, 1st Ed., 1967.
6. Control System for Technicians p Eryan, G.F. ELBS & Holder & Stoughton, 2nd Ed. 1970.
7. Control, System engineering (with notes and worked examples - C. O. Oroge, UPL Ibadan 1986.

Electrical/Electronic Drafting and Design

1. Basic Electronic and Electrical Drafting - Bethuma, J. D., Prentice-Hall, 1980 Ed.
2. Electrical and Electronics Drawing - Baer, C. J. McGraw-Hill, 2nd Ed. 1966.

LIST OF BOOKS FOR COMPUTER TECHNOLOGY COURSES

1. Title: Advanced Microprocessors Architecture
Author: L. Gminiera & A. Valenzane
Publisher: Addison Wesley

2. Title: Digital Signal Processing
Author: R. A. Roberts & C. T. Muuis
Publisher: Addison Wesley

3. Title: Microprocessor Systems 16-bit Approach
Author: W. J. Eccles
Publisher: Addison Wesley

4. Title: Microprocessor Systems 16-bit Approach
Author: H. S. Stone
Publisher: AddisonWesley

5. Title: Introduction to Robotics
Author: H. S. Stone
Publisher: Addision Wesley

6. Title: Pulse Digital and Switching Waveforms
Author: Millman and Taub
Publisher: Addison Wesley

7. Title: FORTRAN 77
Author: Donald M. Munno
Publisher: Harnold

8. Title: Digital Integrated Electronics
Author: Taub
Publisher: TAB Books

9. Title: Computer Technicians Handbook
Author: Margolis A.
Publisher: TAB Books

10. Title: Interfacing Techniques
Author: Joseph Carr
Publisher: TAB Books

11. Title: Computer Peripherals
Author: Barry Wilkinson/David Horrocks
Publisher: Edward Arnold

12. Title: Computing with Fortran IV
Author: Practical Course, Donald M. Monro
Publisher: Edward Arnold

13. Title: Digital Control
Author: A.M. Zikil; Ellis Harwood
Publisher: Edward Arnold

14. Title: Computer Interfacing: Connection to the Real World
Author: M. D. Cripps
Publisher: Edward Arnold

15. Title: Basic Control System Technology
Author: C. J. Chesmond
Publisher: Edward Arnold

16. Title: Control Applications of Microcomputers
Author: P.M. Mitchel
Publisher: Edward Arnold

17. Title: Microprocessor and their Manufacturing Applications
Author: A. K. Kochlan/N.D. Burns
Publisher: Edward Arnold

18. Title: Digital Techniques: From problem specification to realization
Author: Thijssen A.P./Vink, H.A. et al
Publisher: Edward Arnold

19. Title: Checking Experiments in Sequential Machines
Author: A. Bhattacharyya
Publisher: Wiley

20. Title: Security for Computer Networks
Author: D. W. Davies/W.L. Price
Publisher: Wiley

21. Title: Microprocessor System Design Techniques
Author: R. Barnett
Publisher: Wiley

22. Title: The Fifth Generation: The Future of Computer Technology
Author: H.S. U.
Publisher: Wiley

23. Title: Control Applications of Microcomputers
Author: P. Mitchel
Publisher: Hodder Stoughton.

24. Title: Computer Peripherals
Author: Barry Wilkinson/David Horrocks
Publisher: Hodder Stoughton.

25. Title: Basic Principles and Practices of Microprocessors
Author: D. E. Heffer/G.A. King/D.C. Keith
Publisher: Hodder Stoughton.

Guidelines for Text Book Writers

The following guidelines are suggestions from the Engineering Committees to the writers of the textbooks for the new curricula. They are intended to supplement the detailed syllabuses which have been produced, and which define the content and level of the courses.

Authors should bear in mind that the curriculum has been designed to give the students a broad understanding of applications in industry and commerce, and this is reflected in the curriculum objectives.

1. One book should be produced for each syllabus
2. Page size should be A4
3. The front size should be 12 point for normal text and 14 point where emphasis is needed
4. Line spacing should be set to 1.5 lines
5. Headings and subheadings should be emboldened
6. Photographs, diagrams and charts should used extensively throughout the book, and these items must be up-to-date
7. In all cases the material must be related to industry and commerce, using real life examples wherever possible so that the book is not just a theory book. It must help the students to see the subject in the context of the 'real word"
8. The philosophy of the courses is one of an integrated approach to theory and practice, and as such the books should reflect this by not making an artificial divide between theory and practice.
9. Illustrations should labeled and numbered.
10. Examples should drawn from Nigeria wherever possible, so that the information is set in a country context.
11. Each chapter should end with student self-assessment questions (SAG) so that students can check their own master of the subject
12. Accurate instructions should be given for any practical work having first conducted the practical to check that the instructions do indeed work
13. The books must have a proper index or table of contents, a list of references and an introduction based on the overall course philosophy and aims of the syllabus.
14. Symbols and units must be listed and a unified approach used throughout the book
15. In case of queries regarding the contents of the books and the depth of information, the author must contact the relevant curriculum committee via the National Board for Technical Education
16. The final draft version of the books should be submitted to Nigerian members of the curriculum working groups for their comments regarding the content in relation to the desired syllabus.

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UNESCO-NIGERIA PROJECT IN SUPPORT OF REVITILISATION OF TECHNICAL AND VOCATIONAL EDUCATION IN NIGERIA

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