



United Nations  
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# Electrical Engineering Technology National Diploma (ND)

## Curriculum and Course Specifications

NATIONAL BOARD FOR TECHNICAL EDUCATION  
Federal Republic of Nigeria

UNESCO – Nigeria Project

2001

# **Electrical Engineering Technology - National Diploma (ND)**

**National Board for Technical Education  
Curriculum and Course Specifications - 2001  
PLOT B, BIDA ROAD, P.M.B. 2239 KADUNA - NIGERIA  
NATIONAL DIPLOMA (ND) IN ELECTRICAL ENGINEERING TECHNOLOGY**

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# GENERAL INFORMATION

## GOAL AND OBJECTIVES

The programme is designed to produce electrical engineering technicians for the following industries; manufacturing, assembling, servicing, power generation, transmission distribution and utilisation, telecommunications and other related industries. More specifically, diplomates of the programme should be able to:

- 1) Construct simple electrical and electronic circuits when necessary for use in modification or as a part of a system;
- 2) Assemble, install and test-run simple electrical and electronic equipment;
- 3) Carry out both preventive and corrective maintenance on simple electronic/electrical installation, equipment and appliances;
- 4) Select and use appropriate instruments to carry out simple tests and measurement on all types of electrical and electronic installation and equipment under various operating conditions.
- 5) Operate relevant equipment and installations whenever required;
- 6) Prepare simple bills of quantities and specifications related to electrical/electronic engineering works;
- 7) Coordinate and supervise craftsmen in activities related to electrical/electronic engineering services
- 8) Maintain a personal logbook to record his daily and weekly activities for each semester.

## 1.0 GENERAL ENTRY REQUIREMENTS

### National Diploma (ND)

The entry requirements for National Diploma in Electrical Engineering Technology are:

1. **Four credit level passes at senior school certificate examination (SSCE) or its equivalent at not more than TWO sittings. The four subjects must include Mathematics, Physics and any TWO other science subjects. At least a pass in English Language is required.**
2. The National Technician Certificate (NTC) in electrical trade with credit passes in Mathematics, Physics and ONE other subject. Also a pass in English Language is mandatory.
3. Four credit passes in an NBTE recognised preliminary ND course offered in a polytechnics or similar post secondary technical institution. The credit passes must include Mathematics, Physics any TWO science subjects. **Candidates must in addition obtain at least a pass in English language.**

## 2.0 CURRICULUM

1. The curriculum of all ND programme consists of four main components. These are:

1. General studies/Education
2. Foundation courses
3. Professional courses
4. Supervised Industrial Work Experience Scheme (SIWES)

2. The General studies/education component shall include course in:

- i. *Art and Humanities* - English language, communication. These are compulsory
- ii. *Mathematics and Science*
- iii. *Social Studies* - Citizenship, political science, sociology, philosophy, geography, entrepreneurship studies. The courses in citizen, entrepreneurship are compulsory.

3. The General Education/studies components shall account for not more than 15% of the total contact hours for the programmes

4. Foundation courses include courses in Mathematics, Pure Science., Computer Science, Technical Drawing, Descriptive Geometry and Statistics, etc. The number of hour will vary with the programme and many account of hours will vary with the programme and many account for about 10-15% of the total contact hour depending on the programmes.

5. Professional courses are course which give the student the theory and practical skills he needs to practice his field of specialisation at the technician/technologist level. These may account for between 60-70% of the contact hours depending on the programme.

6. Supervised industrial work experience (SIWES) shall be taken during the long vacation following the end of the second semester of the first year. See detail of SIWES at Paragraph 7.0.

## 3.0 CURRICULUM STRUCTURE

### ND programme

The structure of the ND programme consists of four semester of class room, laboratory, field and workshop activities in the college - and a semester (SIWES). Each semester shall be of seventeen (17) weeks duration made up as follows.

1. 15 contact weeks of teaching, i.e lecture, recitation and practical exercise, etc and
2. 2 weeks for test, quizzes, examination and registration SIWES shall take place at the end of the second semester of the first year for the ND programme.

#### **4.0 ACCREDITATION**

Each programme offered either at the ND and HND level shall be accredited by the NBTE before the diplomates can be awarded either of the two diploma certificate. Details about the process of accreditation for the award of the ND or HND programmes are available from the Executive Secretary, National Board for Technical Education, Plot B, Bida Road, P.M.B 2239, Kaduna, Nigeria.

#### **5.0 CONDITIONS FOR THE AWARD OF THE NATIONAL DIPLOMA**

Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed course work, examination, diploma project and the supervised industrial work experience. Such candidates should have completed a minimum of between 65 - 75 semester credit units depending on the programme.

##### **Diploma shall be classified as follows:**

- Distinction - GPA of 3.50 - 4.00
- Upper Credit - GPA of 3.00 - 3.49
- Lower Credit - GPA of 2.50 - 2.99
- Pass - GPA of 2.00 - 2.49
- Fail - GPA of below 2.00

#### **6.0 GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME**

6.1 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 standards from which he is transferring.

6.2 In designing the units, the principle of the modular system by the product has been adopted; thus making each of the professional modules, when completed provides the students with technician operative skills, which can be used for the employment purposes. Also, he can move ahead for post ND studies.

6.3 As the success of the credit unit system depends on the articulation of the programmes between the institution 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 to the diplomate of the programme. There is slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance 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 of the final curriculum may be vetted by the Academic Board of the institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

6.4 The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in profession course and laboratory work should be taught in isolation from the theory. For each course, there should be a balance of theory practice in the ratio of 50:50 or 60:40 or the reverse.

## **7.0 GUIDELINES ON SIWES PROGRAMME**

7.1 For the smooth operation of the SIWES the following guidelines shall apply:

### **i. RESPONSIBILITY FOR PLACEMENT OF STUDENTS**

1. Institution offering the ND programme shall arrange to place the students in the industry. By April 30 of each year; six copies of the master list showing where each student has been placed shall be submitted to the executive secretary, NBTE which shall, in turn authenticate the list and forward it to the Industrial Training Fund, Jos.

2. The Placement Officer should discuss and agree with industry on the following:

- i. A task inventory of what the students should be expected to experience during the period of attachment. It may be wise to adopt the one already approved for each field.
- ii. The industry - based supervisor of the students during the period likewise the institution based supervisor.
- iii. The evaluation of the students during the period. It should be noted that the final grading of the student during the period of attachment should be weighted on the evaluation by his industry-based supervisor.

### **ii. EVALUATION OF STUDENTS DURING SIWES**

In the evaluation of the student, cognisance should be taken of the following items:

- a. Punctuality
- b. Attendance
- c. General Attitude to work
- d. Respect for authority
- e. Interest in the field/technical area
- f. Technical competence as a potential technician in his field.



## **7.2 GRADING OF SIWES**

To ensure uniformity of grading scale, the institution should ensure that uniform grading of student s work which has been agreed to by all polytechnics is adopted.

## **7.3 THE INSTITUTION BASED SUPERVISOR**

The institution-based supervisor should initial the log book during each visit. This will enable him to check and determine to what extent the objectives of the scheme are being met and to assist students having any problems regarding the specific assignments given to them by their industry-based supervisor.

## **7.4 FREQUENCY OF VISIT**

Institution should ensure that students placed on attachment are visited within one month of their placement. Other visits shall be arranged so that

1. There is another visit six weeks after the first visit; and
2. A final visit in the last month of the attachment.

## **7.5 STIPEND FOR STUDENTS IN SIWES**

**The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training Fund and the NBTE.**

## **7.6 SIWES AS A COMPONENT OF THE CURRICULUM**

The completion of SIWES is important in the final determination of whether the student is successful in the programme or not. Failure in the SIWES is an indication that the student has not shown sufficient interest in the field or has no potential to become a skilled technician in his field. The SIWES should be graded also on credit unit system. Where a students has satisfied all other requirements but failed SIWES, he may only be allowed to repeat another four months SIWES at his own expense.

## **8.0 LOG BOOK**

The candidates are expected to record and up-keep a personal logbook. This will contain daily and weekly summary of curricular activities carried out by the candidates for each semester. The ND programme coordinator of the department will supervise the assessment and evaluation of the log book.

# CURRICULUM TABLE

## ND PROGRAMME IN ELECTRICAL ENGINEERING TECHNOLOGY

### 1<sup>st</sup> SEMESTER

Course Code	Course Title	L	T	P	CU	CH
GNS 101	Use of English	2	0	0	2	2
MTH 112	Algebra and Elementary Trigonometry	1	1	0	2	2
SDV 201	Business Entrepreneurship	2	0	0	2	2
MEC 111	Technical Drawing	0	0	4	4	4
MEC 112	Basic Workshop Technology and Practice	1	0	2	3	3
EEC 114	Report Writing	1	0	3	4	4
EEC 112	Introduction to Computer Software	1	0	2	3	3
EEC 117	Computer Hardware I	1	0	2	3	3
EEC 111	Electrical Graphics	1	0	3	4	4
EEC 115	Electrical Engineering Science 1	1	0	2	3	3
TOTAL		11	1	18	30	30

### 2<sup>ND</sup> SEMESTER

Course Code	Course Title	L	T	P	CU	CH
GNS 102	Communication Skills I	2	0	0	2	2
MTH 211	Calculus	1	1	0	2	2
MEC 124	Machine Tools Technology & Practice	1	0	2	3	3
EEC 122	Electrical Power I	1	0	2	3	3
EEC 123	Electrical Machine I	1	0	2	3	3
EEC 124	Electronics I	1	0	2	3	3
EEC 125	Electrical Engineering Science II	1	0	2	3	3
EEC 126	Electrical and Electronic Instrument I	1	0	3	4	4
EEC 128	Telecommunications I	1	0	2	3	3
EEC 129	Electrical Installation of Building	1	0	2	3	3
TOTAL		11	1	17	29	29

**3<sup>RD</sup> SEMESTER**

Course Code	Course Title	L	T	P	CU	CH
GNS 111	Citizen Education	2	0	0	2	2
MTH 202	Logic and Linear Algebra	1	1	0	2	2
EEC 232	Electrical Power II	1	0	2	3	3
EEC 233	Electrical Machines II	1	0	2	3	3
EEC 234	Electronics II	1	0	3	4	4
EEC 236	Electrical and Electronic Instrument II	1	0	2	3	3
EEC 238	Telecommunications II	1	0	2	3	3
EEC 239	Electric Circuit Theory I	1	0	2	3	3
TOTAL		9	1	13	23	23

**4<sup>TH</sup> SEMESTER**

Course Code	Course Title	L	T	P	CU	CH
GNS 202	Communication Skills II	2	0	0	2	2
MTH 122	Trig. And Analytical Geometry	1	1	0	2	2
EEC247	Computer Hardware II	1	0	2	3	3
EEC 242	Electrical Power III	1	0	2	3	3
EEC 244	Electronics III	1	0	3	4	4
EEC 249	Electric Circuit Theory II	1	0	2	3	3
EEC 280	Project	0	0	3	3	3
TOTAL		7	1	12	20	20

# GENERAL STUDIES COURSES

## Use of English

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: USE OF ENGLISH I (GRAMMAR)</b>		<b>Course Code: GNS 101</b>	<b>Contact Hours: 30Hrs Lectures</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: It will promote the necessary language skills which will enable student to cope effectively.</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
1 - 3	1.1 Explain the necessity for acquiring good note-taking/making techniques 1.2 List the methods of note-taking/making 1.3 Explain the use of dictionary 1.4 Explain the use of the library 1.5 Explain the type of information sources in the library 1.6 Identify good reading habits 1.7 Explain the different methods of reading viz, scan, skim, normal and study 1.8 Use the different methods of reading explained in 1.7 above	Ask the students: <ul style="list-style-type: none"> <li>- the techniques of note-taking/making and list the various methods</li> <li>- the correct ways of using the dictionary</li> <li>- the best ways of using the library</li> <li>- to list the various information sources in the library and how to locate these information sources</li> <li>- the different methods of reading and the difference between the methods</li> </ul>	Chalkboard, Duster, Recommended textbooks.
<b>General Objective 2.0: Understand the basic roles of grammar, know the nature of the language, appreciate literary words in English</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
4 - 6	2.1 Explain the concept of language 2.2 List the characteristics of language 2.3 Explain the four language skills, viz: speaking, listening, writing, readings 2.4 Explain the functions of language 2.5 List the uses of English language in Nigeria, e.g as the language of research, government, commerce etc.	Ask the students: <ul style="list-style-type: none"> <li>- the basic concept of language</li> <li>- to mention the characteristics of language</li> <li>- to identify the functions of language</li> <li>- to list the uses of English language in Nigeria</li> </ul>	Chalk and Blackboard

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: USE OF ENGLISH I (GRAMMAR)</b>		<b>Course Code: GNS 101</b>	<b>Contact Hours: 30Hrs Lectures</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 3.0: Understand the basic rules of grammar</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
7 - 10	3.1 Explain grammar 3.2 Explain parts of speech 3.3 Analyse the use of parts of speech in sentences 3.4 Correct common errors in the use of parts of speech in sentences 3.5 Explain how to construct sentences with correct syntactic arrangement 3.6 List punctuation marks 3.7 Enumerate the uses of punctuation marks and explain how to punctuate a given passage 3.8 Explain idioms, figures of speech and affrication	Ask the students: - to explain grammar, parts of speech and how to apply them in a sentence - to identify common errors in the use of parts of speech in sentences - to construct sentences with correct syntactic arrangement - to identify punctuation marks and their uses, and how to punctuate a given passage - to construct sentences to illustrate idioms, figure of speech and affixes	Chalk, Blackboard, Duster

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: USE OF ENGLISH I (GRAMMAR)</b>		<b>Course Code: GNS 101</b>	<b>Contact Hours: 30Hrs Lectures</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Understanding the essential qualities of paragraph</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
11 - 13	4.1 Define a paragraph 4.2 Name the parts of a paragraph viz: topic, sentence, development and conclusion/transition 4.3 Explain the thematic qualities of a paragraph viz, unity, coherence and emphasis 4.4 Explain methods of paragraph development viz, example, definition, comparison and contrast etc 4.5 Explain methods of ordering details in a paragraph, viz, less complex to more complex and vice versa, less important to more important and vice versa, spatial, chronological etc. 4.6 Write specific paragraphs to illustrate 4.2 to 4.5 above	Ask the students: - to define a paragraph and to name the part of a paragraph - what the understand by the thematic qualities of a paragraph - to explain the various methods of paragraph development and the methods of ordering details in a paragraph Assess the students	Chalk, Blackboard and Duster
<b>General Objective 5.0: Appreciating Literary works in English</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
14 - 15	5.1 Give the meaning of literature 5.2 Trace the development of literature 5.3 Differentiate between the literary genres 5.4 Explain the functions of literature 5.5 Explain the terminology of prose fiction, e.g plot setting, characterization etc 5.6 Answer an essay question on a given novel	Ask the students: - the meaning of literature and the development of literature - the functions of literature and the terminology of Prose fiction	Chalk, blackboard, duster
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.			

# Communication Skills I

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: COMMUNICATION SKILL I</b>		<b>Course Code: GNS 102</b>	<b>Contact Hours 30 HRS LECTURES</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Acquire the necessary Communication Skills, techniques of correspondence and comprehend within materials</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	<b>COMMUNICATION</b> 1.1 Define Communication 1.2 Analyse the process of Communication 1.3 Analyse the purposes of Communication 1.4 Explain the relationship between communication and language. 1.5 Explain the impact of interference on communication at various levels e.g. Phonological, syntactic, e.t.c. 1.6 Explain code-mixing, code-switching and dissonance in communication.	• Teachers are expected to involve the students in Communication Skills, and Speed intonation.	Chalk boards; Text-books, Samples of Formal and informal letters.
5 - 8	<b>ORAL PRESENTATION</b> 2.1 Label a diagram of the organs of speech 2.2 Describe the functions of the organs in 2.1 above in speech production. 2.3 List the phonemes of English 2.4 Produce correctly each of the phonemes listed in 2.3 above. 2.5 Pronounce correctly by making distinctions between the different sound contrasts in the consonantal and vowel systems of English. 2.6 Explain the principles of effective speaking, viz; correct use of stress, rhythm, and information patterns. 2.7 Read fluently.		

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>		
<b>Course: COMMUNICATION SKILL I</b>	<b>Course Code: GNS 102</b>	<b>Contact Hours 30 HRS LECTURES</b>
<b>Course Specification: Theoretical Content</b>		
<b>General Objective 1.0: Acquire the necessary Communication Skills, techniques of correspondence and comprehend within materials</b>		
9 - 11	<p><b>CORRESPONDENCE</b></p> <p>3.1 List the various stype of correspondence, e.g. letter, memo, circular, e.t.c.</p> <p>3.2 Explain the various parts of a letter.</p> <p>3.3 Differentiate between formal and informal letter format.</p> <p>3.4 Explain the characteristics of styles suitable for formal and informal letters.</p> <p>3.5 Explain the functions of the first, middle and last paragraphs.</p> <p>3.6 Write a formal and informal letter.</p>	<p>Give students assignments on various ttype of correspondence.</p> <p>Chalk boards; Text-books, Samples of Formal and informal letters.</p>
12 - 15	<p><b>COMPREHENSION AND INTERPRETATION</b></p> <p>4.1 Identify main ideas in a given passage.</p> <p>4.2 Differentiate the main ideas from the details in a passage.</p> <p>4.3 Use the main idea to anticipate specific details in a passage.</p> <p>4.4 Use context clues to aid comprehension.</p> <p>4.5 Identify relationship patterns of ideas in a passage.</p> <p>4.6 Use context clues such as definitions, restatements and examples to derive meanings.</p> <p>4.4 Interpret figurative language in a passage.</p> <p>4.5 Draw conclusions from available information.</p>	<p>Teachers should give necessary * Chalk board; Text-books, Samples of Formal and informal letters.</p> <p>aids that will assist the comprehension of passage.</p>
<p><b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.</p>		



## Communication Skills II

PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING			
Course: COMMUNICATION SKILL II		Course Code: GNS 202	Contact Hours 30 HRS LECTURES
Course Specification :Theoretical Content			
General Objective 1.0: Communicate clearly and effectively in both general and specific situations.			
Week	Specific Learning Outcome:	Teacher Activities	Resources
1 - 4	<b>REGISTERS</b> 1.1 Explain registers. 1.2 Explain factors influencing register, viz; field (profession), mode (speech or writing), tenor (relationship between the interacting parties). 1.3 List some items of register peculiar to different professions. 1.4 Identify items of register in a given passage. 1.5 State appropriate use of jargon.	<ul style="list-style-type: none"> <li>Teachers to emphasize on the items and importance of registers to different professions.</li> </ul>	Text-books, Blackboard, Chalk, Publications, samples of correspondence, Registers and reports.
5 - 7	<b>CORRESPONDENCE</b> 2.1 Describe different types of business letter e.g., applications, enquiries, invitations and complaints, with their replies. 2.2 Use suitable language for a specific type of letter. 2.3 Write the letter listed in 2.1 above.	<ul style="list-style-type: none"> <li>Give exercises to students on letter writing and correspondences and assess.</li> </ul>	
8 - 11	<b>WRITING FOR PUBLICATION</b> 3.1 Explain techniques of writing for publication. 3.2 Write essays on topical and current issues. 3.3 Analyse published essay of literacy value. 3.4 Evaluate the development of ideas in a given article. 3.5 Write good articles for publication.	<ul style="list-style-type: none"> <li>Teachers should involve the class in the analysis of published essays and texts.</li> </ul>	

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>		
<b>Course: COMMUNICATION SKILL II</b>	<b>Course Code: GNS 202</b>	<b>Contact Hours 30 HRS LECTURES</b>
<b>Course Specification :Theoretical Content</b>		
	<b>General Objective 1.0: Communicate clearly and effectively in both general and specific situations.</b>	
12 - 15	<b>REPORT</b> 4.1 Define a report 4.2 List the types of report 4.3 Enumerate uses of report 4.4 List the characteristics of a good report 4.5 Outline the stage of writing a report 4.6 Evaluate a given report 4.7 Write a report.	• Give detail of report writing to students.  Text-books, blackboard, Chalk, Publications, samples of correspondence, Registers and reports.
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.		

# Report Writing

REPORT WRITING Y1/1<sup>ST</sup> SEMESTER 1/0/3HRS/WEEK.

## General Objectives

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

1. Understand how to fill a log book for all technical works carried out
2. Understand how to present project proposal in the standard format
3. Understand the purpose and method of presenting different sections of a project report
4. Understand how to write non-technical report.

## LIST OF ACTIVITIES/EXERCISES

The student is expected to carry out assignments on:

1. Writing sample log book and laboratory experiments.
2. Writing samples of project proposal based on assumed projects.
3. Writing preliminary pages of a project report (i.e. cover page, title page, Approval page, Declaration page, Table of Contents, Acknowledgments, Abstract/Summary, List of symbols/Abbreviation, List of Tables, and List of Figures).
4. Writing body of a report laid out chapter-by-chapter.(i.e. **Chapter 1: Introduction; Chapter 2: Literature Review; Chapter 3: Construction work; Chapter 4: Testing, Results and Discussion; Chapter 5: Conclusion & Recommendation.**)
5. Writing References to a report from different information sources such as: textbooks, journals, past students' projects, Lecturers' notes, Newspaper/Magazine, seminar/workshops etc.
6. Writing appendices to a report (including may be, tables, diagrams, parts list, graphs etc in the appendix).

<b>Course: REPORT WRITING</b>		<b>Course Code: EEC 114</b>	<b>Contact Hours: 1/0/3</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand how to fill a log book for all technical works carried out.</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
1 - 4	<p>1.1 Fill a log book based on works carried out</p> <p>1.2 Write report of a laboratory experiment carried out. (to include: Title of Experiment, Objectives, Background information (theory), Components, Equipment Procedure, schematic diagram(s), Result Analysis, Answers to questions.)</p> <p>1.3 Carry out assignment(s) on 1.1.</p> <p>1.4 Carry out exercise(s) on 1.2.</p>	<ul style="list-style-type: none"> <li>• let the students know what a log book is.</li> <li>• Ask student to fill a log book</li> <li>• Ask students to write a simple laboratory report</li> </ul>	<ul style="list-style-type: none"> <li>• Log book;</li> <li>• Experiments, Data, chalkboard</li> </ul>
5 - 8	<p>2.1 Explain the purpose of the following sections in writing project proposal:</p> <ol style="list-style-type: none"> <li>1. Clients requirements</li> <li>2. Specification</li> <li>3. Proposed drawing</li> <li>4. Cost estimate of materials, labour etc.</li> <li>5. Execution period.</li> </ol> <p>2.2 Write samples of project proposals based on the items listed in (2.1)</p>	<ul style="list-style-type: none"> <li>• Let the students know the importance of each sections in writing project proposal</li> <li>• Ask students to list various clients requirement with their specifications of the proposed diagram</li> </ul>	<ul style="list-style-type: none"> <li>• Samples of Project proposal, chalkboard.</li> </ul>
9 -12	<p>3.1 Explain the purpose of each of the following sections of a project report:</p> <ol style="list-style-type: none"> <li>1. Cover page</li> <li>2. Title page</li> <li>3. Approval page</li> <li>4. Declaration page</li> <li>5. Table of contents</li> <li>6. Acknowledgements</li> <li>7. Abstract/Summary</li> <li>8. List of Symbols/Abbreviation</li> <li>9. List of Tables</li> <li>10. List of Figures</li> <li>11. Body of the project report, divided into chapters</li> </ol> <p>References i. Appendices.</p> <p>3.2 Write a project report based on items listed in 3.1.</p>	<ul style="list-style-type: none"> <li>• Ask the students to identify each section of a project report.</li> <li>• State them in the right order.</li> <li>• Ask them to write out each section separately.</li> </ul>	<ul style="list-style-type: none"> <li>• Samples of a Technical Report, chalk, chalkboard.</li> </ul>

<b>Course: REPORT WRITING</b>		<b>Course Code: EEC 114</b>	<b>Contact Hours: 1/0/3</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand how to fill a log book for all technical works carried out.</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher Activities</b>	<b>Resources</b>
13 - 15	<p>4.1 Explain the purpose of non-technical Report writing</p> <p>4.2 Explain the purpose and approximate contents of a non-technical report including the following:</p> <ol style="list-style-type: none"> <li>1. Background information on project</li> <li>2. Progress report</li> <li>3. New Development (if any)</li> <li>4. Response to correspondence (if any).</li> <li>5. Recommendation.</li> </ol> <p>4.3 Write a non-technical report based on items in 4.2 above.</p>	<ul style="list-style-type: none"> <li>• Prepare a non - technical Report</li> <li>• Ask students to identify the importance of its contents.</li> <li>• Ask students to write out each of the contents separately.</li> </ul>	<ul style="list-style-type: none"> <li>• Samples of a Non-Technical Report, Chalkboard.</li> </ul>
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.			

<b>Course: REPORT WRITING</b>		<b>Course Code: EEC 114</b>	<b>Contact Hours: 0/0/3</b>
<b>Course Specification: Practicals</b>			
<b>General Objective : 1.0 Understand how to fill a log book for all technical works carried out.</b>			
<b>Week</b>	<b>Specific Learning Outcomes:</b>	<b>Teacher Activities</b>	<b>Resources</b>
5 - 6	<p><b>LOGBOOK.</b></p> <p>Ex 1. With the help of the instructor, Design an experiment to verify the measurement of OHMS LAW, having been given a rod of IRON with a resistance of about 10 ohms, and using a dc source of 2.0 volts.</p> <p>Set out all section of the entries with some fictitious readings.</p> <p>Ex 2. Take an example from the field of Electrical Installation to provide a lighting circuit to a room from a mains board. In this case diagrams could be important and should be given careful consideration.</p> <p>Ex.3. Using information given by the instructor on an assignment of installing an aerial, you are required to provide a TV aerial for a customer at his home.</p> <p>Write the log on the basis of what you feel it will involve, including some imaginary costs of transport, and time taken., costed at some price.</p>	<ul style="list-style-type: none"> <li>• Considerable general guidance will be required from the instructor.</li> <li>• Preparation of some relevant data will be needed for the students to use in the assignments.</li> <li>• Some cost guidance should also be provided by the instructor</li> </ul>	<ul style="list-style-type: none"> <li>• Log book, samples of project proposal,</li> <li>• Technical Reports,</li> <li>• Non- Technical Reports.</li> </ul>

<b>Course: REPORT WRITING</b>		<b>Course Code: EEC 114</b>	<b>Contact Hours: 0/0/3</b>
<b>Course Specification: Practicals</b>			
<b>General Objective : 1.0 Understand how to fill a log book for all technical works carried out.</b>			
<b>Week</b>	<b>Specific Learning Outcomes:</b>	<b>Teacher Activities</b>	<b>Resources</b>
7 - 15	<p><b>PROJECT PROPOSALS</b> Write a project proposal for the customer requiring the Aerial Installation.</p> <p><b>LABORATORY ASSIGNMENTS</b> Write a Laboratory report on the Verification of Ohms Law.</p> <p><b>WORKSHOP ASSIGNMENTS</b> Write a report on the wiring of the room assignment.</p> <p><b>TECHNICAL REPORT</b> Write essays on some research topic such as the supply of electrical energy to a typical house in Nigeria.</p> <p><b>NON TECHNICAL REPORT</b> About midway in the Aerial Installation assignment your Manager (Non Technical) has asked you to give him a progress report of about one page length. Provide one.</p>	<p>-do-</p> <p>-do-</p>	<p>-do-</p> <p>-do-</p>
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.			

## Citizen Education

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: CITIZEN EDUCATION</b>		<b>Course Code: GNS 111</b>	<b>Contact Hours 2HRS/WEEK</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the Constitution of Nigeria</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
1 - 4	1.1 Explain the term constitution 1.2 Distinguish the different types of constitution 1.3 Highlight some provisions of an International Constitution 1.4 Explain the effectiveness of International Constitution 1.5 Explain the supremacy of the Nigerian Constitution to other laws with emphasis on the 1989 constitution 1.6 Evaluate the main parts of the Nigeria Constitution 1.7 Draft a constitution for an association 1.8 Trace the historical development of the Nigerian Constitution 1.9 Discuss the merits and demerits of each of the Nigerian constitutions 1.10 Explain the concept of "rule of law"	Ask the students: <ol style="list-style-type: none"> <li>1. what their understand by the term constitution and to distinguish the different rules of constitution known</li> <li>2. to explain the effectiveness of International Constitution</li> <li>3. to explain Nigerian Constitution to other laws.</li> <li>4. To identify the main parts of the Nigerian Constitution.</li> <li>5. Assess to the students by given the assignment to draft a constitution for an association</li> </ol>	Chalkboard, duster

<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: CITIZEN EDUCATION</b>		<b>Course Code: GNS 111</b>	<b>Contact Hours 2HRS/WEEK</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Understand the federal system of government in Nigeria</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
5 - 7	2.1 Describe a federation 2.2 Distinguish a federation from a confederation 2.3 Outline the basis for the federal system in Nigeria 2.4 Examine the evolution, structure and functions of the federal system in Nigeria. 2.5 Analyse the relationships among the three tiers of government in Nigeria 2.6 Evaluate the revenue allocation formula in operation in Nigeria 2.7 Compare and contrast other federation with Nigeria	Ask the students:  6. to describe a federation and to differentiate between a federation and a confederation  7. to define the functions of the federal system in Nigeria and the relationship among the three tiers of government  8. to evaluate the revenue allocation formula operation in Nigeria	Chalk, blackboard, duster
<b>General Objective 3.0: Know the constitutional rights and obligations of Nigerian citizens</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
8 - 9	3.1 Examine the significance of rights and obligations in Nigeria 3.2 Assess government's protection of fundamental rights as contained in the Nigerian constitution	Ask the students to identify the responsibilities and duties of Nigerian citizenship	Chalk, blackboard, duster
	3.3 Evaluate the responsibilities and duties of Nigerian citizenships and the benefits for performing them 3.4 Assess the responsibilities and duties of constituted authority to the people 3.5 Evaluate the responsibilities and duties of government to the people		



<b>PROGRAMME: NATIONAL DIPLOMA ELECTRICAL ENGINEERING</b>			
<b>Course: CITIZEN EDUCATION</b>		<b>Course Code: GNS 111</b>	<b>Contact Hours 2HRS/WEEK</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Understand Citizenships</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
10 - 12	4.1 Discuss the significance of citizenship 4.2 Analyse the principles and benefits of citizenship 4.3 Explain the difference in the modes of acquiring citizenship 4.4 Evaluate the merits and demerits of each type of citizenship 4.5 Analyse the basis for the acquisition and withdrawal of Nigerian citizenship 4.6 Examine the benefits derivable from Nigeria citizenship	Ask the students: - to discuss and analyse the principles and benefits of citizenship - to analyse the basis for the acquisition and withdrawal of Nigerian citizenship	Chalk, blackboard, duster
<b>General Objective 5.0: Fundamental objectives and directive principles of state policy in Nigeria</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
13 - 15	5.1 State the fundamental obligations of government as provided in the constitution 5.2 Explain the general provisions of the fundamental objectives and directive principles of state policy 5.3 Explain the political, economic, social and education policies of Nigeria 5.4 Explain the directive principles and policy of the Nigerian government on culture, the mass media, national ethics and duties of the citizen 5.5 Assess the conformity observance and application of the fundamental objectives and directive principles of state policy by governments and people of Nigeria. 5.6 Recommend improvements on the provision conformity, observance and application of the fundamental objectives and directive principles of state policy	Ask the students to explain the directive principles and policy of the Nigerian government on cultures, the mass media, national ethnics and duties of the citizen	Chalk, blackboard, duster
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.			

# MATHEMATICS COURSES

## Algebra and Elementary Trigonometry

### General Objectives

On completion of this course the student will be able to:

1. Understand the laws of indices and their application in simplifying algebraic expressions.
2. Understand the theory of logarithms and surds and their applications in manipulating expressions.
3. Understand principles underlying the construction of charts and graphs.
4. Know the different methods of solving quadratic equations.
5. Understand permutation and combination
6. Understand the concept of set theory
7. Understand the properties of arithmetic and geometric progressions
8. Understand the binomial theorem and it's application in the expansion of expressions and in approximations.
9. Understand the basic concepts and manipulation of vectors and their applications to the solution of engineering problems.
10. Understand the concept of equations and methods of solving different types of equations and apply same to engineering problems.
11. Understand the definition, manipulation and application of trigonometric functions.

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>		<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand laws of indices and their applications in simplifying algebra expressions</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
1	1.1 Define index 1.2 Establish the laws of indices 1.3 Solve simple problems using the laws of indices.		• Chalkboard, Textbooks, Calculators.

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>		<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Understand Theory of logarithms surds and their applications in manipulating expression</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
2 - 3	2.1 Define logarithm 2.2 Establish the four basic laws of logarithm 2.3 Solve simple logarithm problem 2.4 Define natural logarithm and common logarithm. 2.5 Define characteristic and mantissa 2.6 Read the logarithmic table for given numbers 2.7 Simplify numerical expressions using log tables e.g. $18D = 3\sqrt{4JPC^2 \Delta M^B}$ , find D when J = 0935, e.g. $\Phi = 35$ , $P = 1.6 \cdot 10^6$ , $C = 55$ , $M = 0.0025$ . $\Pi = 3.142$ 2.8 Apply logarithm in solving non-linear equations. e.g. $y = ax^n$ ; $\log y - \log a + n \log x$ ; $y = bc^x = \log y = \log b + x \log c$ ; $Y = a + bx^n - \log(Y - D) = \log b + n \log x$ . 2.9 Define surds 2.10 Reduce a surd into its simplest form 2.11 Solve simple problems on surds	<ul style="list-style-type: none"> <li>Ask the students to solve logarithmic and surd related problems</li> </ul>	- do -
<b>General Objective 3.0: Understand Principles underlying the construction of Charts and graphs</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
4	3.1 Construct graphs of functions fractions such as $Y = ax + b$ , $n = 1, 2$ $Y = CST(a+x)$ $Y = ax^k$ , including cases of asymptotes 3.2 Apply knowledge from 3.1 in determination as laws from experimental data.	<ul style="list-style-type: none"> <li>Ask the students to draw graphs</li> </ul>	-do-

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>		<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Know the different methods of solving quadratic equations</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
5	4.1 Solve quadratic equations by factorization 4.2 Solve quadratic equations by method of completing squares. 4.3 Solve quadratic equations by formula 4.4 Discriminate the roots. 4.5 Form equations whose roots are given in different methods.	• Ask the students to solve quadratic equations	-do-
<b>General Objective 5.0: Understand Permutations and Combinations</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
6	5.1 Define permutation 5.2 State examples of permutations 5.3 Define combination 5.4 State examples of combination 5.5 Establish the theorem $nPr = \frac{n!}{(n-r)!}$ giving examples e.g. number of ways of collecting two out of 8 balls	• Give exercises on permutation and combination to them	-do-
<b>General Objective 6.0: Understand the concept of set theory</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
7	6.1 Establish ${}^nC_r = {}^nC_{n-r}$ . 6.2 Define sets, subsets, and null sets 6.3 Define union, inter-section and completion of sets 6.4 Draw Venn diagrams to demonstrate the concepts in 6.1 - 6.3 above. 6.5 Calculate the size or number of elements in a given set.	-do-	-do-

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>	<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
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**Course Specification: Theoretical Content**

<b>General Objectives 7.0: Understand the properties of arithmetic and geometric progressions</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
8 - 9	7.1 Define an Arithmetic progression (A.P.) 7.2 Obtain the formula for nth term and the first n terms of an A.P. 7.3 Give examples of the above e.g. find the 20 <sup>th</sup> term of the series e.g. $2 + 4 + 6 + \dots$ . Find also the series of the first 20 terms. 7.4 Define a geometric progression (G.P.) 7.5 Obtain the formula for the nth term and the first n terms of a geometric series. 7.6 State examples of 7.5 above e.g. given the sequences $1/3, 1, 3, 1/4$ find the 20 <sup>th</sup> term and hence the sum of the first 20 terms. 7.7 Define Arithmetic Mean (AM) and Geometric Mean (G.M.) 7.8 Define convergency of series. 7.9 Define divergence of series.	Ask the students to apply progression to solve problems	-do-

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>		<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objectives 8.0: Understand the binomial theorem and it's application in the expansion of expressions and in approximations.</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
10	<p>8.1 Explain the method of mathematical induction</p> <p>8.2 State and prove the binomial theorem for a positive integral index.</p> <p>8.3 Expand expressions of the forms <math>(x + y)^2</math>, <math>(x^2 - 1)^s</math> applying binominal theorem</p> <p>8.4 Find the coefficient of a particular term in the expansion of simple binomial expressions.</p> <p>8.5 Find the middle term in the expansion of binomial expression</p> <p>8.6 State the binomial theorem for a rational index.</p> <p>8.7 Expand expressions of the form: <math>(1 + x)^{-1}</math>, <math>(1 - x)^{\frac{1}{2}}</math>, <math>(1 - x) -</math> applying binomial theorem</p> <p>8.8 Expand and approximate expressions of the type <math>(1.001)^n</math>, <math>(0.998)^n</math>, <math>(1 + x)^{\frac{1}{2}}</math>, <math>(1 - x)</math>-to a stated degree of accuracy applying I scalar expressions.</p>	<p>• State the importance and application of the theorem</p>	-do-
11	<p>9.1 State the definitions and representations of vectors.</p> <p>9.2 Define a position vector.</p> <p>9.3 Define unit vector</p> <p>9.4 Explain scalar multiple of a vector</p> <p>9.5 List the characteristics of parallel vectors</p> <p>9.6 Identify quantities that may be classified as vector e.g. displacement velocity, acceleration, force etc.</p> <p>9.7 Compute the modulus of any given vector up to 2 and 3 dimensions.</p> <p>9.8 State the parallelogram law in solving problems including addition and subtraction of vectors</p> <p>9.9 Apply the parallelogram law in solving problems including addition and subtraction of vectors.</p> <p>9.10 Explain the concept of components of a vector and the meaning of orthogonal components.</p> <p>9.11 Resolve a vector into its orthogonal components.</p> <p>9.12 List characteristics of coplanar localized vectors.</p> <p>9.13 Define the resultant or composition of coplanar vectors.</p>	<p>Apply the techniques of vectors to solve various problems</p>	-do-

<b>COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY</b>		<b>COURSE CODE: MTH 112</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objectives 9.0: Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
12	9.14 Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. 9.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. 9.16 Apply vectoral techniques in solving problems involving relative velocity. 9.17 State the scalar product of two vectors. 9.18 Compute the scalar product of given vectors. 9.19 Define the cross product of the vector product of two vectors. 9.20 Calculate the direction ratios of given vectors. 9.21 Calculate the angle between two vectors using the scalar product.	<ul style="list-style-type: none"> <li>Apply the techniques of vector to solve various problems</li> </ul>	-do-
<b>General Objectives 10.0: Understand the Concept of equations and apply same to engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcomes</b>	<b>Teacher Activities</b>	<b>Resources</b>
13 - 14	10.1 Explain the concept of equation, ie. $A = B$ where A and B are expressions. 10.2 List different types of equations:- Linear, quadratic, cubic, etc. 10.3 State examples of linear simultaneous equations with two unknowns and simultaneous equations with at least one quadratic equation. 10.4 Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation. 10.5 Apply the algebraic and graphical methods in solving two simultaneous quadratic equations. 10.6 Define a determinant of $n^{\text{th}}$ order. 10.7 Apply determinants of order 2 and 3 in solving simultaneous linear equations.	<ul style="list-style-type: none"> <li>Ask the student to solve various equations as indicated in section 10</li> </ul>	-do-

COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY		COURSE CODE: MTH 112	CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL
<b>Course Specification: Theoretical Content</b>			
General Objectives 11.0: Understand the definition, manipulation and application of trigonometric functions			
Week	Specific Learning Outcomes	Teacher Activities	Resources
15	<p>11.1 Define the basic trigonometric ratios, sine, cosine and tangent of an angle.</p> <p>11.2 Derive the other trigonometric ratios; cosecant, secant and cotangent using the basic trigonometric ratios in 11.1 above.</p> <p>11.3 Derive identities involving the trigonometric ratios of the form; <math>\text{Cos}^2\Phi + \text{Sin}^2\Phi = 1</math>, <math>\text{Sec}^2\Phi = 1 + \tan^2\Phi</math>, etc.</p> <p>11.4 Derive the compound angle formulae for <math>\sin (A+B)</math>, <math>\text{Cos} (A+B)</math> and <math>\text{Tan} (A+B)</math>.</p>	<ul style="list-style-type: none"> <li>Define and Derive the trigonometric ratios and identities</li> </ul>	-do-
<b>ASSESSMENT:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.			



# Calculus

## General Objectives

On completion of this course the student will be able to:

1. Understand the basic concepts of differential calculus and its application in solving engineering problems.
2. Know integration as the reverse of differentiation and its application to engineering problems.
3. Understand first order homogenous linear ordinary differential equation's with constant coefficients as applied to simple circuits.
4. Understand the basic concepts of partial differentiation and apply same to engineering problems.

PROGRAMME: NATIONAL DIPLOMA IN ELECTRICAL ENGINEERING			
COURSE : CALCULUS		Course Code: MTH 211	Contact Hours 3/0/0
Course Specification: Theoretical Content			
	General Objective: 1.0 Understand the basic concepts of differential Calculus and in application in solving engineering problems		
Week	Specific Learning Outcome	Teachers Activities	Resources
1 - 4	1.1 Define limits with examples 1.2 State and prove basic theorems on limits 1.3 Prove that $\lim_{\Phi \rightarrow 0} \frac{\sin \Phi}{\Phi}$ , $\lim_{\Phi \rightarrow 0} \frac{\tan \Phi}{\Phi} = 1$ 1.4 Define differentiation as an incremental notation or a function. 1.5 Differentiate a function from first principles. 1.6 Prove the formulae for derivative of functions, Function of a function, products, and quotient of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. 1.8 Derive second derivative of a function. 1.9 Apply differentiation to simple engineering and technological problems. 1.10 Explain the rate of change of a function 1.11 Explain the condition for turning point of a function.	Teachers are to give and solve simple engineering and technological problems	Chalkboard, textbooks, lecture notes, chalk

<b>PROGRAMME: NATIONAL DIPLOMA IN ELECTRICAL ENGINEERING</b>			
<b>COURSE : CALCULUS</b>		<b>Course Code: MTH 211</b>	<b>Contact Hours 3/0/0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic concepts of differential Calculus and in application in solving engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
	1.12 Distinguish between maximum and minimum value of a function. 1.13 Sketch the graph of a function showing its maximum and minimum points and points of inflexion. 1.14 Estimate error quantities from the small increment of a function. 1.15 Determine the tangent to a curve. 1.16 Determine the normal to a curve.		
<b>General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 8	2.1 Define integration as the reverse of differentiation. 2.2 Explain integration as a limit of summation of a function. 2.3 Distinguish between indefinite and definite integrals. 2.4 Determine the indefinite and definite integrals. 2.5 Determine the definite integral of a function. 2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions. 2.7 List possible methods of integration. 2.8 Integrate algebraic and trigonometric functions by the substitution method 2.9 Integrate trigonometric and exponential functions by parts 2.10 Integrate algebraic functions by partial fraction. 2.11 Integrate trigonometric and logarithmic functions applying reduction formula. 2.12 State standard forms of some basic integrals. 2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, center of gravity, center of surface area, second moment and moment of inertia. 2.14 Define Trapezoidal and Simpson's rule as methods of approximating areas under given	Ask students to apply integral calculus to simple function	-do-

<b>PROGRAMME: NATIONAL DIPLOMA IN ELECTRICAL ENGINEERING</b>			
<b>COURSE : CALCULUS</b>		<b>Course Code: MTH 211</b>	<b>Contact Hours 3/0/0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
	curves. 2.15 Find approximate area under a curve applying Trapezoidal method. 2.16 Find approximate area under a curve applying Simpson's rule. 2.17 Compare result obtained from Trapezoidal and Simpson's rules with the results by direct integration. 2.18 Apply integration to kinematics.		
<b>General Objective 3.0: Understand first order homogenous linear ordinary equations with constant coefficients as applied to simple engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
9 - 12	3.1 Define first order differential equation 3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations. 3.3 List examples of various types of first order differential equations. 3.4 Define first order homogenous differential equations 3.5 List the methods of solving differential equations by separable variables. 3.6 Identify differential equations reducible to the homogenous form. 3.7 Explain exact differential equations. 3.8 Solve exact differential equations, e.g. (a) Show that $(3x^2 + y \cos x) dx + (\sin x - 4y^3) dy = 0$ is an exact differential equation. (b) Find its general solution. 3.9 Define integrating factors. 3.10 Determine the solution of differential equations using integrating factors. 3.11 Define linear differential equations of the first order.	Ask students to apply differential equation to solve engineering problems	-do-

<b>PROGRAMME: NATIONAL DIPLOMA IN ELECTRICAL ENGINEERING</b>			
<b>COURSE : CALCULUS</b>		<b>Course Code: MTH 211</b>	<b>Contact Hours 3/0/0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Understand the basic concepts of partial differentiation and apply same to engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
13 - 15	4.1 Define partial differentiation 4.2 List and explain the uses of partial derivatives. 4.3 Solve problems on partial differentiation. e.g. f (x, y) = $x^2 + y^2 = 2xy$ find $dy/dx$ , $dx/dy$ 4.4 Apply partial differentiation to engineering problems.	Solve problems on partial differential	-do-
<b>Assessment:</b> The continuous assessment, test and quizzes will be awarded 40% of the total score. The end of the semester Examination will make up for the remaining 60% of the score			

# Logic and Linear Algebra

## General Objectives

On completion of this course the student will be able to:

1. Understand the basic rules of mathematical logic and their application to mathematical proofs.
2. Know permutations and combinations
3. Compute the binomial expansion of algebraic expansions.
4. Understand the algebraic operations of matrices and determinants as well as solve simultaneous linear equations by the methods of matrices.

<b>COURSE: LOGIC AND LINEAR ALGEBRA</b>	<b>COURSE CODE: MTH 202</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>	
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: On completion of this course, the students should be able to:</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	1.1 The essential connectives, negation, conjunction, disjunction, implication and bi-implication 1.2 State the essential connectives defined in 1.1 above. 1.3 Explain grouping and parenthesis in logic, 1.4 Explain Truth Tables. 1.5 Define tautology 1.6 Give examples of types of tautology. e.g 5. If P and Q are distinct atomic sentences, which of the following are tautologies? (a) $P - Q$ (b) $P \cup Q - Q \cup P$ (c) $P \vee (P * Q)$ ii. Let P = Jane Austen was a contemporary of Beethoven. Q = Beethoven was a contemporary of Gauss. R = Gauss was a contemporary of Napoleon S = 'Napoleon was a contemporary of Julius Caesar'. (Thus P, Q and R are true, and S is false).	Explain and illustrate 1.1 to 1.6 and ask the students to find the truth value of the logic statement  Assess the student	Lecture notes, Recommended textbooks, charts, chalkboard

<b>COURSE: LOGIC AND LINEAR ALGEBRA</b>		<b>COURSE CODE: MTH 202</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: On completion of this course, the students should be able to:</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	Then find the truth values of sentences:- (a) $(P * Q) = R$ (b) $(P - Q)$ (c) $P * Q - R - S$		
3 - 4	1.7 Define universal quantifier and existential quantifier. 1.8 Translate sentences into symbolic form using quantifiers. e.g. 'some freshmen are intelligent' can be stated as for some x, x, is a freshman and x is intelligent' can translate in symbols as $(\exists x) (Fx \& Ix)$ . 1.9 Define the scope of a quantifier 1.10 Define 'bound' and 'free' variables 1.11 Define 'term' and formula' 1.12 Give simple examples of each of 1.9 to 1.11 above. 1.13 Explain the validity of formulae	Explain and illustrate 1.7 to 1.2 and asked the students to solve problems on 1.7 to 1.11	Recommended textbooks, lecture notes, chalkboard, chalk
<b>General Objective 2.0: Know permutation and combination</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 7	2.1 Define permutations and combinations 2.2 Give illustrative examples of each of 2.1 above 2.3 State and approve the fundamental principle of permutation. 2.4 Give illustrative examples of the fundamental principles of permutation. 2.5 Establish the formula ${}^n P_r = n! / (n - r)!$ 2.6 Prove that $n P_r = (n - r + 1) \times n P_{(r - 1)}$ . 2.7 Solve problems of permutations with restrictions on some of the objects. 2.8 Solve problems of permutations in which the objects may be repeated.	Explain and illustrate the activities in 2.1 to 2.15 and ask the student to:  - establish the formula $n P_r = n! / (n-r)!$ - Prove that $n P_r = (n-r+1)(n P_{(r-1)})$ - Establish the formula $n C_r = n! / [n-r]!$ - Prove that $n C_r = n C_{n-r}$	Recommended textbooks, lecture notes, chalkboard, chalk

<b>COURSE: LOGIC AND LINEAR ALGEBRA</b>	<b>COURSE CODE: MTH 202</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
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**Course Specification: Theoretical Content**

**General Objective 2.0: Know permutation and combination**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 7	2.9 Describe circular permutations. 2.10 Solve problems of permutation of N things not all different. 2.11 Establish the formula ${}^n C_r = n! / [(n - r)! r!]$ 2.12 Solve example 2.11 2.13 State and prove the theorem ${}^n C_r = {}^n C_{n-r}$ . 2.14 Solve problems of combinations with restrictions on some of the objects. 2.15 Solve problems of combinations of n different things taken any number at a time.		

**General Objective 3.0: Know binomial theorem**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8 - 10	3.1 Explain with illustrative examples - the method of mathematical induction. 3.2 State and prove binomial theorem for positive integral index. 3.3 Explain the properties of binomial expansion. 3.4 State at least seven (7) examples of 3.3 above. e.g. i. $(x^2 - 1/x)$ ii. Find the constant term in the expansion of $(x + 1/x)^A$ iii. Find the co-efficient of $x^v$ in the expansion of $(x + k)^A$ where v is a number lying between -n and n- 3.5 State the binomial theorem for a rational number 3.6 State the properties of binomial co-efficients. 3.7 Apply binomial expansion in approximations (simple examples only).	Explain and illustrate activities in 3.1 to 3.7 and ask the students to solve them	• Recommended textbooks, lecture notes, chalkboard, chalk, etc

<b>COURSE: LOGIC AND LINEAR ALGEBRA</b>		<b>COURSE CODE: MTH 202</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Know matrices and determinants</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 15	<p>4.1 Define Matrix</p> <p>4.2 Define the special matrices - zero matrix, identify matrix - square matrix, triangular matrix, symmetric matrix, skew symmetric matrix.</p> <p>4.3 State example for each of the matrices in 4-2 above.</p> <p>4.4 State the laws of addition and multiplication of matrices.</p> <p>4.5 Illustrate the commutative, associative, and distributive nature of the laws states in 4.4 above.</p> <p>4.6 Explain the transpose of a matrix.</p> <p>4.7 Determine a determinant for <math>2 \times 2</math> and <math>3 \times 3</math> matrices.</p> <p>4.8 Define the minors and cofactors of a determinant.</p> <p>4.9 Explain the method of evaluating determinants.</p> <p>4.10 State and prove the theorem "Two rows or two columns of a matrix are identical, then the value of its determinant is zero".</p> <p>4.11 State and prove the theorem "If two rows or two columns of a matrix are interchanged, the sign of the value of its determinant is changed".</p> <p>4.12 State and prove the theorem "If any one row or one column of a matrix is multiplied by a constant, the determinant itself is multiplied by the constant".</p> <p>4.13 State and prove the theorem "If a constant times the elements of a row or a</p>	<p>Explain and illustrate the activities in 4.1 to 4.19. Ask the student to prove the theorems and solve problems on the illustrated activities. Assess the student</p>	<p>• Recommended textbooks, lecture notes, chalkboard, chalk, etc</p>



<b>COURSE: LOGIC AND LINEAR ALGEBRA</b>		<b>COURSE CODE: MTH 202</b>	<b>CONTACT HOURS: 15 HRS LECTURE 15 HRS TUTORIAL</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Know matrices and determinants</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 15	<p>column are added to the corresponding elements of any other row or column, the value of the determinant itself is multiplied by the constant".</p> <p>4.14 State five examples of each of the theorems in 4. 10-4 13 above.</p> <p>4.15 Define the adjoint of a matrix</p> <p>4.16 Explain the inverse of a matrix.</p> <p>4.17 State the linear transformations on the rows and columns of a matrix.</p> <p>4.18 Apply Cramer's rule in solving simultaneous linear equation.</p> <p>4.19 Apply Linear transformation in solving simultaneous linear equations.</p>		
<b>Assessment:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score			

# Trigonometry and Analytical Geometry

## General Objectives

On completion of this course the student will be able to:

1. Understand the manipulation of Trigonometric Formulae and equations
2. Understand the concept of Mensuration and its application to Engineering problems.
3. Understand concept of Analytical Geometry and their applications.
4. Know the different forms of conics such as ellipse, Parabola and hyperbola.

<b>COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY</b>		<b>COURSE CODE: MTH 122</b>	<b>CONTACT HOUR: 2/0/0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the manipulation of trigonometric equations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 3	<p>1.1 Convert sums and differences of trigonometric ratios to products:</p> $\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$ $\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$ <p>1.2 Prove the sine and cosine formulae of triangles</p> <p>1.3 Solve triangles using the sine and cosine formulae e.g.:- The sides a,b,c, of a triangle are 4cm, 5cm, and 6cm respectively. Find the angles.</p> <p>1.4 Calculate angles of elevation and depression using trigonometric ratios e.g.:- From the top of a tree 120m high an observer sees a boat 560m away. Calculate the angle of depression.</p> <p>1.5 Compute bearings, heights and distances of inaccessible objects and projections, e.g. - A man walks 3 km due N, and the 3 km N.52° W. How far is the of his starting point? What is his bearing from his original position.</p> <p>1.6 Derive half angle formulae fro sin, cos and tan.</p> <p>1.7 Define inverse circular function.</p> <p>1.8 Explain inverse circular functions graphically.</p>	<ul style="list-style-type: none"> <li>• Illustrate with good examples to 1.10 and ask the students to solve problems on them.</li> <li>• Assess the student</li> </ul>	<ul style="list-style-type: none"> <li>• Recommended textbooks, lecture notes, chalkboard, chalk, etc</li> </ul>

<b>COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY</b>		<b>COURSE CODE: MTH 122</b>	<b>CONTACT HOUR: 2/0/0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the manipulation of trigonometric equations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	1.9 Solve problems involving 1.8 and e.g.:- Draw the graph of $1/(\cos 2\theta)$ Taking values from $0^\circ$ to $90^\circ$ inclusive. 1.10 Apply the concepts in 1.8 above to three dimensional problems.		
<b>General Objective 2.0: Understand the concept of mensuration and its application to engineering problems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 5	2.1 Explain circular measure 2.2 State the relation between radians and degrees 2.3 Prove the formulae for arc length and area of a sector. 2.4 Identify segment and chord of a circle. 2.5 Determine the area of a segment and the chord of length of a given circle. 2.6 Calculate the surface areas and volumes of simple shapes such as cylinder, sphere and cone. E.g. A solid sphere has radius 8cm. Calculate its volume. 2.7 Determine the areas and volumes of irregular shapes applying Simpsons rule. 2.8 Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.		
<b>General Objective 3.0: Understand the concept of analytical geometry and their applications</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
6 - 9	3.1 Explain two dimensional coordinate systems: Cartesian and Polar-coordinate systems. 3.2 Explain plotting and sketching of graphs w.r.t. the two coordinate systems. 3.3 Relate Cartesian coordinate to polar coordinates. 3.4 Explain the slope of a line in relation to the above concepts in 3.3. above. 3.5 Explain the intercept of a line. 3.6 Derive the formula for the gradient of line passing through two	<ul style="list-style-type: none"> <li>• Illustrate the activities in 3.1 to 3.20 with good examples and ask the students to solve problems on them.</li> <li>• Assess the</li> </ul>	<ul style="list-style-type: none"> <li>• Lecture notes, recommended textbooks, chalkboards, chalk, duster etc.</li> <li>• Recommended textbook, lecture notes, chalkboard, chalk etc.</li> </ul>

COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY		COURSE CODE: MTH 122	CONTACT HOUR: 2/0/0
Course Specification: Theoretical Content			
General Objective 3.0: Understand the concept of analytical geometry and their applications			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	<p>points.</p> <p>3.7 Derive the equation of a straight line given the gradient and the co-ordinates of a point.</p> <p>3.8 Reduce a given linear equation to the intercept form. <math>x/a + y/b = 1</math></p> <p>3.9 Determine the coordinates of the point of intersection of two straight lines.</p> <p>3.10 Define locus</p> <p>3.11 Derive the slope-intercept form of the equation of a straight line: <math>y = mx+c</math></p> <p>3.12 Derive the point - slope form of the equation of a straight line: <math>y - y_1 = m(x - x_1)</math></p> <p>3.13 Derive the double - point form of the equations of the straight line:</p> $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$ <p>3.14 Derive the perpendicular form of the equation of a straight line</p> <p>3.15 Solve examples of 3.11 to 3.14 above.</p> <p>3.16 Find the angle (Q) between two lines whose slopes, (<math>m_1</math>, and <math>m_2</math>) are Known: <math>Q = \tan^{-1} \frac{m_2 - m_1}{1 + m_1 m_2}</math></p> <p>3.17 Determine the conditions for two lines to be parallel and to be perpendicular.</p> <p>3.18 Derive the expression for the perpendicular distance from a point to a line.</p> <p>3.19 Draw a circle.</p> <p>3.20 Derive the equation of a circle with center at the origin and radius r.</p>	<p>students</p> <ul style="list-style-type: none"> <li>• Illustrate the activities in 3.21 to 3.26 and ask the students to solve problems on them</li> </ul>	
10 - 11	<p>3.21 Derive the equation of a circle with center outside the origin.</p> <p>3.22 State general equation of a circle.</p> <p>3.23 Determine the coordinates of the center of a circle from a given equation of a circle.</p> <p>3.24 Draw orthogonal circles</p>		

COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY		COURSE CODE: MTH 122	CONTACT HOUR: 2/0/0
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 3.0: Understand the concept of analytical geometry and their applications</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	3.25 Find the equations of the tangent and the normal at a point circle 3.26 List illustrative examples of each of 3.20 to 3.25 above		
12 - 15	4.1 Define the Parabola 4.2 Derive the standard equation of a Parabola $y^2 = 4ax$ 4.3 State the properties of the parabola 4.4 Define the focal chord, axis and lotus rectum of the parabola 4.5 Determine the equation of the tangent and normal from a given point to the parabola. 4.6 Solve problems on parabola e.g. Write down the equation of the parabola and state its vertex if the focus - is (2,0) and the directrix $x = - 2$ . 4.7 Define and ellipse 4.8 Derive the equation of an ellipse $x^2/a^2 + y^2/b^2 = 1$ 4.9 State the properties of the ellipse 4.10 Determine the equation of the tangent and the normal to an ellipse from a given point. 4.11 Define focal chord and axes of ellipse. 4.12 Solve problems on ellipses e.g. Find the length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$ 4.13 Define the Hyperbola 4.14 Derive the equation of the Hyperbola 4.15 Identify the properties of the Hyperbola. 4.16 Define asymptotes, chord, tangent and normal to a hyperbola. 4.17 Solve problems on hyperbola e.g. Find the foci and directrices for hyperbola: $x^2/16 - y^2/9 = 1$ 4.18 Explain rectangular hyperbola 4.19 Determine tangent and normal to the rectangular hyperbola.		
<b>Assessment:</b> The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score			

# BUSINESS COURSES

## Entrepreneurship Development I

<b>PROGRAMMES: ELECTRICAL ENGINEERING</b>			
<b>Course: Entrepreneurship Development I</b>		<b>Course Code: SDV 210</b>	<b>Contact Hours: 2 - 0 - 0</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic concept of entrepreneurship</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
1	1.1 Define entrepreneurship, entrepreneur, small business and self-employment. 1.2 State the entrepreneurship philosophy and identify entrepreneurial characteristics. 1.3 Identify entrepreneurial characteristics. 1.4 Define development enterprise.	Lecture and site examples of each.	Chalkboard
<b>General Objective 2.0: Understand the historical perspective of entrepreneurship development</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
2	2.1 Historical perspective. 2.2 Trace the origin of entrepreneurship. 2.3 Explain organizational structure. 2.4 Explain the role of an entrepreneur. 2.5 Explain the reasons for business failure.	Trace the historical evolution of business enterprise citing example Highlight the reasons for their failure/success.	Chalkboard
<b>General Objective 3.0: Know how to plan a business enterprise/project.</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
3	3.1 Define the concepts: planning, business enterprise and project. 3.2 Explain the importance of planning to a business enterprise. 3.3 Analyse the skills and Techniques of starting and managing small business successfully.	Lecture and illustrate with examples. Highlight to the students the initial problems likely to be faced Invite a successful entrepreneur to deliver lecture to the students.	Chalkboard
4 - 5	3.4 Prepare and present project proposal. 3.5 Manage a small business profitably.	Lecture and introduce the students to the formats of various project proposals.	Chalkboard

<b>PROGRAMMES: ELECTRICAL ENGINEERING</b>			
<b>Course: Entrepreneurship Development I</b>		<b>Course Code: SDV 210</b>	<b>Contact Hours: 2 - 0 - 0</b>
<b>General Objective 4.0: Know how to operate simple stock keeping records</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
6	4.1 Ordering spare parts/materials 4.2 Receipt of parts/materials 4.3 Storage of parts/materials 4.4 Issue of parts/materials	Lecture and demonstrate to students how to write receipt and keep records of ordering, storage and issue materials.	Store or any storage facility Record note-books.
<b>General Objective 5.0: Know how to prepare and operate cash flow on spreadsheets</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
7 - 8	5.1 Need for different records (capital, revenue, credit transaction, tax) 5.2 Formatting spreadsheet 5.3 Operating spreadsheet	Lecture and demonstrate for the students to appreciate Give practical exercise to students.	Chalkboard and Computer
<b>General Objective 6.0: Understand employment issues</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
9	Employment Issues 6.1 Define the terms: education, training and development. 6.2 Relate education, training and development to employment. 6.3 Distinguish between skills and employment. 6.4 Explain the role of the private sector in employment generation.	Lecture and cite examples.	Chalkboard.
	6.5 Identify the forms and informal sectors. 6.6 Explain the issues of: (i) Rural youth and employment (ii) Urban youth and employment.		
<b>General Objective 7.0: Understand the Nigerian Legal System</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
10	7.1 Explain the nature of law. 7.2 Analyse the sources of Nigerian laws. 7.3 Evaluate the characteristics of Nigerian Legal System.	Lecture	Chalkboard

<b>PROGRAMMES: ELECTRICAL ENGINEERING</b>			
<b>Course: Entrepreneurship Development I</b>		<b>Course Code: SDV 210</b>	<b>Contact Hours: 2 - 0 - 0</b>
<b>General Objective 8.0: Comprehend the nature of contract and tort</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
11	Nature of Contract and Tort 8.1 Define contract. 8.2 Explain types of contracts 8.3 State the basic requirements for a valid contract. 8.4 Analyse contractual terms.	Lecture	Chalkboard
12	8.5 Examine vitiating terms. 8.6 Explain breach of contract and remedies. 8.7 Define Tort. 8.8 Explain types of Tort. 8.9 Discuss tortuous liabilities and remedies.	Lecture	Chalkboard
<b>General Objective 9.0: Understand Agency and Partnership</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
13 - 15	Agency and Partnership 9.1 Define agency 9.2 Explain creation of agency 9.3 Explain authority of the agent. 9.4 Analyse the rights and duties of principal agent and third parties. 9.5 Explain termination of agency and remedies.	Lecture	Chalkboard
	9.6 Define partnership. 9.7 Examine creation of partnership. 9.8 Explain relations of partners to one another and to persons dealing with them. 9.9 Analyse dissolution of partnership and remedies	Lecture and cite examples	Chalkboard



<b>PROGRAMMES: ELECTRICAL ENGINEERING</b>			
<b>Course: Entrepreneurship Development I</b>		<b>Course Code: SDV 210</b>	<b>Contact Hours: 2 - 0 - 0</b>
<b>General Objective 8.0: Comprehend the nature of contract and tort</b>			
<b>Week</b>	<b>Special Learning Objectives</b>	<b>Teachers Activities</b>	<b>Resources</b>
	<p><b>Assessment:</b> Coursework 20% Course tests 20% Practical 0% Examination 60%.</p> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Wole Adewumi, "Business Management An Introduction", McMillan Nig. Ltd. Lagos. 1988.</li> <li>2. Soji Olokoyo, "Small Business Management Guide Entrepreneurs", Ola Jamon Printers and Publishers, Kaduna.</li> </ol>		

# COMPUTER COURSES

## Introduction to Computer Software

EEC 112 INTRODUCTION TO COMPUTER SOFTWARE Y1/1<sup>ND</sup> SEM 1/0/2 HRS/WK

### Outcomes:

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

1. Understand the basics functions of a computer as a human-machine interacting system.
2. The relationship between the computer - human interface.
3. Operating Language of Individual packages and their functions.

PROGRAMME: ELECTRICAL ENGINEERING			
Course: Introduction to Computer software		Course Code: EEC 112	Contact Hours: 2/0/3
<p><b>Course Objectives:</b> To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</p>			
<p><b>Key Objectives:</b> The outcome from the learning process should be that the student would be able to do the following.</p>			
Week	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1. Define what is meant by a computer. 1.2. Explain the history of computer development (briefly). 1.3. State the uses of computers and explain the impact of the PC on computer technology. 1.4. Differentiate between hardware and software. 1.5. State the input-process-output algorithm (hardware). <ol style="list-style-type: none"> <li>i. Central processor</li> <li>ii. Input mechanisms</li> <li>iii. Output mechanisms</li> </ol>	<ul style="list-style-type: none"> <li>• Define what is meant by a Computer.</li> <li>• Teach the history of Computers developments. (Briefly).</li> <li>• Teach the uses of computers and the impact of PC on the society: home, office, banks etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Maximum of 4 students to 1 computer.</li> <li>• Maximum of 4 computers to a printer except when a Network is in use.</li> <li>• 1 Ream of A4 papers to 10 students.</li> <li>• 4 Ink cartridge per printer per semester.</li> </ul>
2	1.6. Demonstrate how data is stored <ol style="list-style-type: none"> <li>i. RAM</li> <li>ii. ROM</li> <li>iii. Fixed discs</li> </ol>	<ul style="list-style-type: none"> <li>• Explain the need for data storage.</li> </ul> Dismantle a computer system and show the students the RAM card, the Hard Disk and the Processors.	

PROGRAMME: ELECTRICAL ENGINEERING			
Course: Introduction to Computer software		Course Code: EEC 112	Contact Hours: 2/0/3
<p><b>Course Objectives:</b> To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</p>			
<p><b>Key Objectives:</b> The outcome from the learning process should be that the student would be able to do the following.</p>			
Week	Specific Learning Outcome	Teacher's Activities	Resources
2	iv. Removable discs 1.7. Explain the concept of an operating system i. PC-DOS/MS-DOS ii. Windows iii. Linux iv. Unix	<ul style="list-style-type: none"> <li>• Explain the concept of an operating system.</li> </ul>	
3	1.8. Access computers correctly through Windows operating system. i. Open/Close a window ii. Program Manager iii. Button bars/scroll bars/menu bars iv. Moving from one window to another	<ul style="list-style-type: none"> <li>• Discuss the advantage of the Windows Operating System.</li> <li>• Explain the windows menu and tools. Each student must be given an opportunity to start a computer, open/close the window operating system, understand the program manager and move around in the windows environment.</li> </ul>	
4	1.9. Explain file management and how to manage files. i. Creating a file and folder. ii. Manipulating files (moving, copying, saving, deleting). iii. Print manager.	<ul style="list-style-type: none"> <li>• Explain the process of creating a file, manipulating the file and use of the print manager.</li> </ul>	
	1.10. Explain the concept of a software package. i. MS Office ii. Lotus Smartsuite iii. MS Encarta	<ul style="list-style-type: none"> <li>• Load MS Office with the students and explain the various packages that make up MS Office. Load MS.</li> <li>• Encarta and discuss its use with the students.</li> </ul>	

PROGRAMME: ELECTRICAL ENGINEERING			
Course: Introduction to Computer software		Course Code: EEC 112	Contact Hours: 2/0/3
<p><b>Course Objectives:</b> To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</p>			
<p><b>Key Objectives:</b> The outcome from the learning process should be that the student would be able to do the following.</p>			
Week	Specific Learning Outcome	Teacher's Activities	Resources
5 - 6	<p>1.11. Demonstrate ability in the competent use of a word-processing package such as MS Word (or equivalent standard).</p> <ul style="list-style-type: none"> <li>i. Entering text</li> <li>ii. Formatting text (boldening, font size, italicizing).</li> <li>iii. Creating and Saving text files</li> <li>iv. Editing and moving text</li> <li>v. Importing objects</li> <li>vi. Spelling and Grammar Checking.</li> <li>vii. Creating and manipulating tables, text boxes, equations.</li> <li>viii. Printing</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the installation of MS Words.</li> <li>• Identify the different features of the software.</li> <li>• Ask students to type a short document and save it.</li> <li>• Ask students to edit a document and carry out a spelling check.</li> <li>• Demonstrate the use of tables.</li> </ul>	
7 - 9	<p>1.12. Demonstrate ability in the competent use of a graphics package such as Corel Draw (or equivalent standard).</p> <ul style="list-style-type: none"> <li>i. Drawing tools</li> <li>ii. Text as graphics</li> <li>iii. Creating and saving image files</li> <li>iv. Editing and moving images</li> </ul>	<ul style="list-style-type: none"> <li>• Load Corel Draw.</li> <li>• Explain features of the soft wares.</li> <li>• Demonstrate the creating and saving of images.</li> <li>• Edit the images saved.</li> <li>• Export the graphics to other packages.</li> <li>• Demonstrate the manipulation (re-sizing) of images.</li> </ul>	

PROGRAMME: ELECTRICAL ENGINEERING			
Course: Introduction to Computer software		Course Code: EEC 112	Contact Hours: 2/0/3
<p><b>Course Objectives:</b> To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</p>			
<p><b>Key Objectives:</b> The outcome from the learning process should be that the student would be able to do the following.</p>			
Week	Specific Learning Outcome	Teacher's Activities	Resources
7 - 9	<ul style="list-style-type: none"> <li>v. Importing and exporting graphics</li> <li>vi. Windows 'Clipboard' facility</li> <li>vii. Creating and manipulating images (re-sizing etc).</li> <li>viii. Image file standard (JPEG, PCX, GIF etc)</li> <li>ix. Printing</li> </ul>		
10 - 11	<p>1.13. Demonstrate ability in the competent use of a spreadsheet package such as MS Excel (or equivalent standard).</p> <ul style="list-style-type: none"> <li>i. Setting up the worksheet</li> <li>ii. Entering data</li> <li>iii. Formatting data (decimal places, alpha-numeric)</li> <li>iv. Creating and saving worksheets</li> <li>v. Creating a formula in cells</li> <li>vi. Importing objects</li> <li>vii. Exporting the worksheet</li> <li>viii. Creating and manipulating</li> </ul>	<ul style="list-style-type: none"> <li>• Load MS Excel.</li> <li>• Explain features of the software.</li> <li>• Create a worksheet and edit it.</li> <li>• Demonstrate how to format a workshop.</li> </ul>	

PROGRAMME: ELECTRICAL ENGINEERING			
Course: Introduction to Computer software		Course Code: EEC 112	Contact Hours: 2/0/3
<p><b>Course Objectives:</b> To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</p>			
<p><b>Key Objectives:</b> The outcome from the learning process should be that the student would be able to do the following.</p>			
Week	Specific Learning Outcome	Teacher's Activities	Resources
10 - 11	graphical representations of data ix. Printing		
12 - 13	1.14. Demonstrate ability in the competent use of a database package such as MS Access (or equivalent standard). <ol style="list-style-type: none"> <li>i. Drawing tools</li> <li>ii. Text as graphics</li> <li>iii. Creating &amp; saving image files</li> <li>iv. Editing &amp; moving images</li> <li>v. Importing &amp; exporting graphics</li> <li>vi. Windows 'Clipboard' facility</li> <li>vii. Creating &amp; manipulating images (re-sizing etc)</li> <li>viii. Image file standards (JPEG, PCX, GIF etc)</li> <li>ix. Printing</li> </ol>	<ul style="list-style-type: none"> <li>• Load MS Access.</li> <li>• Explain the features and working of the software.</li> <li>• Use students record as example and enter the records in the structure query modify and produce typical report.</li> <li>• Show how to index and sort files in alphabetical order.</li> </ul>	
14 - 15	1.15. Use the Internet to retrieve information. <ol style="list-style-type: none"> <li>i. World Wide Web (WWW)</li> <li>ii. Download information</li> </ol>	<ul style="list-style-type: none"> <li>• Show students how to look on to the Internet.</li> <li>• Write and send an email.</li> <li>• Surf the net.</li> </ul>	

<b>PROGRAMME: ELECTRICAL ENGINEERING</b>			
<b>Course: Introduction to Computer software</b>		<b>Course Code: EEC 112</b>	<b>Contact Hours: 2/0/3</b>
<b>Course Objectives: To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centered, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.</b>			
<b>Key Objectives: The outcome from the learning process should be that the student would be able to do the following.</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Resources</b>
	<ul style="list-style-type: none"> <li>iii. Paste retrieved information into an appropriate application</li> <li>iv. Use e-mail to send and receive messages.</li> <li>v. National and international e-mail</li> <li>vi. E-mail attachments (sending &amp; receiving)</li> </ul>		
	<p><b>Assessment:</b> Coursework 20%; Course test 20%; Practical 10%; Examination 50%.</p> <p><b>Competency:</b> The student should be expose to understand basic computer programming.</p> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>1. Chapra, S.C. and Canale, R.P. "Introduction to Computing for Civil Engineers, Mcgrew hil, 1994</li> <li>2. Press, W.H., Teukolsky, S.A., Vetterling, W.T. and Fannery, B.P. "Numerical recipes". Cambridge Univ. Press, 1993.</li> </ul>		

# Introduction to Computer Hardware I

EEC 117 COMPUTER HARDWARE I Y1/2NDSEM 1/0/2 HRS/WK

**OUTCOME:**

On completion of this module, the student should be able to identify and assemble computer units and make them operational.

<b>COURSE: COMPUTER HARDWARE I</b>			
<b>Course Specification: Theoretical Content</b>		<b>COURSE CODE: EEC 117</b>	<b>CONTACT HOUR: 15 HRS LECTURE 15 HRS PRACTICAL</b>
<b>General Objective: 1.0 Diagnose simple faults on a computer and rectify them</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers activities</b>	<b>Resources</b>
1-3	1.1 Explain briefly the evolution of Computer from ENIAC to present technology.	<ul style="list-style-type: none"> <li>• Introduce the students to technical aspects of cables connecting the units.</li> <li>• Explain how data is transferred down the cables and the type of hand-shake methods used.</li> </ul>	Computer auxiliary units, Computer peripherals, tools and measuring instruments and central processing units, I/O devices.
4-5	1.2 List major sub units of a Computer ( Mother board (XT and AT), Drives (Hard disk, Floppy, CD-ROM, Zip), Ports.		
	1.3 Explain briefly the operation of Computer		
	1.4 Draw a block diagram showing the interconnection of the Sub-units of the mother board.		
	1.5 Identify the memory, ports, CPU, power supply, battery supply for memory retention		
6 - 7	1.6 Identify the protocols of various types port: Parallel, Serial; USP.	- do -	- do -
	1.7 Explain the functions of the Ports listed 3.1 above.		
	1.8 Demonstrate how to connect Computer Ports to peripherals.		
8 - 9	1.9 Explain the characteristics of monitors such as Scanning Speed, Colour resolution etc.		
	1.10 Explain briefly the functions and operation of monitors		



<b>COURSE: COMPUTER HARDWARE I</b>			
<b>Course Specification: Theoretical Content</b>		<b>COURSE CODE: EEC 117</b>	<b>CONTACT HOUR: 15 HRS LECTURE 15 HRS PRACTICAL</b>
<b>General Objective: 1.0 Diagnose simple faults on a computer and rectify them</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers activities</b>	<b>Resources</b>
8 - 9	1.11 Select monitors for different mother boards speed and resolution.		
10 - 11	1.12 Explain briefly the operation of a Printer. 1.13 List different types of Printer (e.g. Line, Dot, Laser, Deskjet etc.) 1.14 State the difference between various types of Printer heads. 1.15 Identify pin connection role of Printer Ports such as Parallel, Serial USP.		
12 - 15	1.16 Identify a modem 1.17 Draw a block diagram of a modem 1.18 Explain briefly the operation of a modem 1.19 Explain the classification of modems (V Series and X Series) 1.20 Identify Modem Ports 1.21 Demonstrate the connection of a Modem to Computer . 1.22 Explain what determines Modem Speed Introduce briefly the concepts of networking.		
<b>ASSESSMENT:-</b> The Practical class will be awarded 40% of the total score. Continuous assessment, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination			

## Computer Hardware II

EEC 247 Computer Hardware II Y2/4<sup>th</sup> SEMESTER 1/0/2 Hrs/wk

### OUTCOMES:

On completion of this module, the student should be able to diagnose simple faults on a computer and rectify them.

PROGRAMME: ND IN ELECTRICAL ENGINEERING TECHNOLOGY			
Course: COMPUTER SOFTWARE II		Course Code: EEC 247	Contact Hour: 15hrs Theory, 15hrs. Practical
Course Specification: Theoretical Content			
General Objective: : Diagnose simple faults on a computer and rectify them			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2 4 - 3 5 - 6	Simple Fault finding on Computers. 1.1 Draw up a list of possible faults that could be easily identified from external symptoms. (Area of concern are Power supplies, Clocks, Memory battery low, I/O ports, disk drives voltages, keyboard, monitors, disc drives, scratches on discs) 1.2 Identify faults on the mother-board from symptoms on the monitor. 1.3 Evaluate if fault is hard ware or soft ware 1.4 Connect drives to Mother board 1.5 Test	<ul style="list-style-type: none"> <li>In this module Instructors should give students activity to explore with ample time to absorb the difficult issues involved, and to ask questions almost on a one to one basis.</li> <li>Instructor should help the students draw the list of faults to build up a database for diagnosis.</li> <li>Instructor should attempt to collect faulty boards for student use whenever possible and use them in the workshop.</li> </ul>	<ul style="list-style-type: none"> <li>Computer auxiliary units, computer peripheral units, central processing units(CPU), I/O devices, tools and measuring instruments.</li> </ul>
7 - 8 9 - 11 12	1.6 Install and Remove Memory Modules 1.7 Identify various cards installed in bus slots. 1.8 Identify different types of slots and their purpose.. 1.9 Do a literature survey of peripherals available in the market. Note the trends of data transfer methods and ports used. 1.10 Install a Modem 1.11 Set modem parameters on the		

<b>PROGRAMME: ND IN ELECTRICAL ENGINEERING TECHNOLOGY</b>			
<b>Course: COMPUTER SOFTWARE II</b>		<b>Course Code: EEC 247</b>	<b>Contact Hour: 15hrs Theory, 15hrs. Practical</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: : Diagnose simple faults on a computer and rectify them</b>			
<b>Week</b>	<b>Specific Learning Outcome</b>	<b>Teachers Activities</b>	<b>Resources</b>
9 - 11 12	computer		
13 14-15	1.12 Install a UPS device making a suitable cable. 1.13 Note different types of MICE 1.14 Make RS-232-C interface Cable 1.15 Assembling and disassembling a Computer System		
<b>ASSESSMENT:</b> The Practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the Semester Examination score			

# MECHANICAL ENGINEERING COURSES

## Basic Workshop Technology and Practice

MEC 112 BASIC WORKSHOP TECHNOLOGY AND PRACTICE YI/1<sup>ST</sup> SEMESTER 1/0/2 Hrs/Wk

### OUTCOMES:

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

1. Know safety precautions.
2. Use and maintain various bench tools.
3. Use simple measuring and testing requirements.
4. Know drilling and reaming operation.
5. Know various metal joining operation.
6. Cut and joint metal by gas welding.
7. Know various metal arc welding operations.
8. Know the various wood working tools and operations.
9. Know simple operations on plastics.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Basic Workshop Technology & Practice		CODE: MEC 112	CONTACT HOURS: 1 HOUR PER WEEK
Course Specification: Theoretical Content			
General Objective 1.0: Know safety precautions			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 4	1.1 Observe safety precautions 1.2 Use protective wears 1.3 Observe all safety rules and regulation.	Ask students to observe safely precaution in the workshop Discuss some unsafe acts in the workshop. Ask students to list out protective wears in the workshop. Discuss the types. Discuss and list out safety rules in the workshop Discuss and differentiate between measuring and testing. Explain the principle and	Chalkboard, textbooks, micrometer screw gauge, vernier calliper, steel rule, drill bits.

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: Basic Workshop Technology &amp; Practice</b>		<b>CODE: MEC 112</b>	<b>CONTACT HOURS: 1 HOUR PER WEEK</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Know safety precautions</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4		<p>construction of micrometer screw gauge and vernier calipers.</p> <p>Perform simple measuring exercises using steel rule, vernier calipers and micrometers</p>	
<b>General Objective 2.0: Know drilling operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 7	<p>2.1 Discuss the nomenclature of a twist drill</p> <p>2.2 Discuss the formulae for calculation of speed of various sizes of drills</p> $n = v \times 1000$ $\lambda \times d$ <p>n = no. of rev/min</p> <p>d = dia of drill in mm</p> <p>v = cutting speed</p>	<p>Ask student to grind drill bits accurately</p> <p>Ask students to select correct drilling speed</p>	-do-
<b>General Objective 3.0: Know various metal joining operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8 - 9	<p>3.1 Select correct tapping drill size</p> <p>3.2 Select correct taps</p> <p>3.3 Fabricate metal container by knock-up joining</p> <p>3.4 Carry out soft soldering</p>	<ul style="list-style-type: none"> <li>• Calculate the tapping drill size for v-threads.</li> <li>• Discuss and indicate how thread are characterised a. Pitch b. No. of starts c. Profile of thread d. Direction of thread</li> <li>• Discuss in detail</li> <li>• Discuss the various metal joining methods</li> <li>• Distinguish between soldering and brazing</li> <li>• Discuss the importance of using flux.</li> </ul>	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Basic Workshop Technology & Practice		CODE: MEC 112	CONTACT HOURS: 1 HOUR PER WEEK
Course Specification: Theoretical Content			
General Objective 4.0: Know the various wood working tools and operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10 - 15	<p>4.1 Know and state the applications of the following:</p> <p>9. Geometric/markings out tools e.g. try square, dividers and gauges</p> <p>10. Planning tools e.g. Jack, smooth, try planes, spoke shaves, etc.</p> <p>11. Cutting tools e.g. saws chisels, knives, boring tools</p> <p>12. Impelling tools e.g. hammer and mallets</p> <p>13. Pneumatic tools</p> <p>4.2 Describe portable electric hand tools in wood work, e.g. portable saw, portable planer, portable drill, portable sander and jig saw.</p> <p>4.3 Explain the operations of the tools in 4.1</p> <p>4.4 Carry out various woodwork operations using the tools in 4.1</p> <p>4.5 List basic wood working machine's such as</p> <ol style="list-style-type: none"> <li>1. Surface planning and thickening machine</li> <li>2. Circular sawing machine</li> <li>3. Morticing machine</li> <li>4. Drilling machine</li> <li>5. Single ended tenning machine</li> <li>6. Band sawing machines and safety precaution in their operations</li> </ol>	<p>List and state the applications of this tools</p> <p>Discuss with the student in more details the use of this tools</p> <p>Ask students to identify the tools in 4.1 and describe them.</p> <ul style="list-style-type: none"> <li>• Ask students to explain the use and operation of the tool in 4.1</li> <li>• Ask students to use the tools in 4.4 for the operations on an exercise or training model.</li> <li>• Ask student to identify the machines in</li> </ul> <p>4.5 • State the safety precaution on the machines in</p> <p>4.5</p>	<ul style="list-style-type: none"> <li>• Try Square</li> <li>• Divider</li> <li>• gauges</li> <li>• Jack planes</li> <li>• Smooths</li> <li>• Try plane</li> <li>• Panel saws</li> <li>• Chisels</li> <li>• Knives</li> <li>• Boring tools</li> <li>• Hammers</li> <li>• Mallets</li> <li>• Portable saw</li> <li>• Portable planer</li> <li>• Portable drill</li> <li>• Portable sander</li> <li>• Jig saw</li> </ul>

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: Basic Workshop Technology &amp; Practice</b>		<b>CODE: MEC 112</b>	<b>CONTACT HOURS: 1 HOUR PER WEEK</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Know the various wood working tools and operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>

<b>ASSESSMENT:</b> - The practical class will be awarded 40% of the total score. The continuous assessment, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of the Semester Examination score.
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<b>COURSE: BASIC WORKSHOP TECHNOLOGY &amp; PRACTICE</b>	<b>COURSE CODE: MEC 112</b>	<b>CONTACT HOURS: L = 1, P= 2 3HRS Per /WK</b>
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**Theoretical Content: PRACTICAL CONTENT**

**General Objective 1.0: Know safety precautions.**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	1.1 Observe safety precautions 1.2 Operate safety equipment e.g. fire extinguishers, safety water hose etc. 1.3 Use of protective wears 1.4 Observe all safety rules and regulations	<ul style="list-style-type: none"> <li>• Let students know that when accident happens on the workshop, they are caused               <ul style="list-style-type: none"> <li>a. Discuss some unsafe acts and condition in the workshop</li> </ul> </li> <li>• Let students know why the workshop is arranged as it is vis-a-vis               <ul style="list-style-type: none"> <li>a. gangway</li> <li>b. exit doors</li> <li>c. machine layout</li> <li>d. illumination/ventilation</li> </ul> </li> <li>• Ask students to differentiate between               <ul style="list-style-type: none"> <li>a. type of fires and medium to extinguish them operate fire extinguishers.</li> </ul> </li> <li>• List types of protective wears suitable for the mechanical workshop               <ul style="list-style-type: none"> <li>a. Overall</li> <li>b. Safety boots</li> <li>c. Eye glasses (safety)</li> <li>d. Hand gloves etc.</li> </ul> </li> <li>• Ask students to state safety rules applicable</li> </ul>	<ul style="list-style-type: none"> <li>• CO<sub>2</sub> fire extinguisher</li> <li>• Water hose</li> <li>• Sand buckets</li> </ul>

<b>COURSE: BASIC WORKSHOP TECHNOLOGY &amp; PRACTICE</b>		<b>COURSE CODE: MEC 112</b>	<b>CONTACT HOURS: L = 1, P= 2 3HRS Per /WK</b>
<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 1.0: Know safety precautions.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2		to mechanical workshop	
3	<p>2.1 Use marking-out tools on the bench correctly</p> <p>2.2 Produce simple objects using bench/hand tools such as files, chisels, scrapers, saws etc.</p> <p>2.3 Maintain files, dividers, saws, gauges try squares, bevel edge square etc.</p>	<ul style="list-style-type: none"> <li>• Ask students to differentiate between <ul style="list-style-type: none"> <li>a. Hand tools and machine tools</li> <li>b. Bench tools and machine cutting tools</li> </ul> </li> <li>• Ask students to list out marking out tools used on the bench typical workshop practical exercises. <ul style="list-style-type: none"> <li>a. Ask students to identify this bench cutting tools</li> <li>b. Ask students to write process sheet or operation layout for the component to be produced.</li> </ul> </li> <li>• Explain the use of this tools and their care</li> <li>• Explain the effect of not using this tools properly and keeping them in good working condition</li> </ul>	<ul style="list-style-type: none"> <li>• Work bench</li> <li>• Bench vice</li> <li>• Hammers</li> <li>• Set of drills</li> <li>• Steel rule</li> <li>• Scribes</li> <li>• Scribing blocks</li> <li>• Inside and outside caliper</li> <li>• Surface place</li> <li>• Dividers</li> <li>• Centre punches, hammers</li> <li>• Files</li> <li>• Chisels</li> <li>• Scrapers</li> <li>• Hook saw</li> <li>• Bench drilling machine &amp; access</li> <li>• Sets of drills</li> <li>• Bevel edge sq.</li> <li>• File card or wine brush</li> <li>• Chamous cloth</li> </ul>



<b>COURSE: BASIC WORKSHOP TECHNOLOGY &amp; PRACTICE</b>	<b>COURSE CODE: MEC 112</b>	<b>CONTACT HOURS: L = 1, P= 2 3HRS Per /WK</b>
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**Theoretical Content: PRACTICAL CONTENT**

**General Objective 3.0: Use simple measuring and testing equipment**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 5	<p>3.1 Perform simple measuring exercises using steel rules, vernier calipers and micrometers.</p> <p>3.2 Use dial indicators to (i) set up job jobs on the lathe (ii) roundness testing etc.</p> <p>3.3 Carry out exercises involving flatness squareness, straightness and surface finish test.</p>	<ul style="list-style-type: none"> <li>• Ask students to differentiate the differing between measuring and testing in the workshop.</li> <li>Ask students to use               <ul style="list-style-type: none"> <li>a. measuring instruments</li> <li>b. testing instruments</li> </ul> </li> <li>Explain               <ul style="list-style-type: none"> <li>a. the principle and construction of a micrometer screw gauge</li> <li>b. the least count of micrometer</li> <li>c. principle and construction of a vernier caliper and the least count.</li> <li>d. The types of micrometers</li> <li>e. The types of vernier calipers</li> <li>f. Accuracy of a steel rule</li> </ul> </li> <li>• Explain to the students the principle and construction of a dial indicator, their types and their accuracy</li> <li>Show students the following:               <ul style="list-style-type: none"> <li>a. Types of surface finish achievable in the workshop</li> <li>b. Differentiate between flatness, and straightness.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Micrometers- external &amp; internal</li> <li>• Vernier calipers</li> <li>• Steel rule</li> <li>• Test mandrel/test bar</li> <li>• 070 x 300mm long dial indicator with stand</li> </ul>

<b>COURSE: BASIC WORKSHOP TECHNOLOGY &amp; PRACTICE</b>	<b>COURSE CODE: MEC 112</b>	<b>CONTACT HOURS: L = 1, P= 2 3HRS Per /WK</b>
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**Theoretical Content: PRACTICAL CONTENT**

**General Objective 3.0: Use simple measuring and testing equipment**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 5	3.4 Perform taper measurement on jobs using vernier protractor and sine bars. 3.5 Inspect jobs using simple comparators	a. Discuss different between the use of Vernier protractor and sine bar and their limitations. b. Ask students to state types of comparators and use them to inspect jobs.	<ul style="list-style-type: none"> <li>• spirit level</li> <li>• surface roughness tester (portable type)</li> <li>• SURF TEST 4</li> <li>• 90° angle gauge</li> <li>• straight edge</li> <li>• vernier protractor</li> <li>• sine bar</li> <li>• set of standard slip gauges</li> <li>• marking out table</li> <li>• bench comparator</li> <li>• 0 - 100mm</li> <li>• S-d Test mandrels</li> </ul>

**General Objective 4.0: Know drilling operations**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5	4.1 Operate different types of drilling machine 4.2 Carry out drilling operations such as counter-boring and counter-sinking 4.3 Grind drill bits accurately Select correct drilling speeds	Differentiate between <ul style="list-style-type: none"> <li>a. drilling and boring operations</li> <li>b. radial drilling and sensitive drilling machine</li> </ul> Ask students other types of drilling machine <ul style="list-style-type: none"> <li>a. Pillar</li> <li>b. Column</li> <li>c. Multi spindle etc</li> </ul> Ask students to differentiate between <ul style="list-style-type: none"> <li>a. Counter boring and counter sinking</li> </ul>	<ul style="list-style-type: none"> <li>• Radial drilling machine</li> <li>• Bench drilling machine</li> <li>• Pillar drilling machine</li> <li>• Column type drilling machine</li> </ul>
6		Ask students to indicate the nomenclature of a twist drill. <ul style="list-style-type: none"> <li>a. clearance angle</li> <li>b. rake angle</li> </ul>	<ul style="list-style-type: none"> <li>• Counter boring drills</li> <li>• Counter sinking drills</li> <li>• Centre drills.</li> <li>• Pedestal grinding</li> </ul>

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<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 4.0: Know drilling operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
6		<p>c. point angle etc.</p> <p>Ask students to calculate the speeds of various sizes of drills using appropriate formulae</p> $n = v \times 1000$ $\pi \times d$ <p>v = cutting speed d = dia of drill in (mm) n = no. of rcvs/min.</p>	machine attached with a twist drill grinding attachment.
<b>General Objective 5.0: Know reaming operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
7	<p>5.1 Carry out reaming operations</p> <p>a. on the bench</p> <p>b. on drilling/lathe</p> <p>5.2 Select correct speeds for reaming small and large holes.</p>	<ul style="list-style-type: none"> <li>• Ask students to do reaming operation on a practical workshop exercise as figure 2</li> <li>• Ask students to drill a ream small; and large holes using correct speeds and feed and appropriate lubricants.</li> </ul>	<ul style="list-style-type: none"> <li>• Hand reamers</li> <li>• Machine reamers</li> <li>• Tap wrench</li> <li>• Jacobs chuck and key</li> <li>• Medium size Lathe</li> <li>• Reduction sleeves</li> <li>• Radial drilling machine</li> <li>• Pillar drilling machine</li> <li>• Reamers (machine)</li> </ul>
<b>General Objective 6.0: Know tapping operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8	<p>6.1 Select correct tapping drill size</p> <p>6.2 Select correct taps</p> <p>6.3 Carry out tapping operation (i) on the work bench (ii) on drilling machine (iii) on lathe</p>	<p>Ask students - the purpose of tapping operation</p> <p>a. Calculate tapping drill size using appropriate formulae</p> <p>Ask students to indicate how taps are characterized</p> <p>a. pitch of the thread b. number of starts c. profile of the thread d. direction of the thread</p>	<ul style="list-style-type: none"> <li>• Taps and wrenches</li> <li>• Drill chuck and key</li> <li>• Lathe machine - medium size</li> <li>• Bench drilling machine</li> <li>• Pillar drilling machine</li> <li>• Cutting fluid or lubricants</li> </ul>

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<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 6.0: Know tapping operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8		show students the correct method of holding taps  a. at the bench b. on the drilling machine c. on the lathe  Ask students to top some of holes already drilled	
<b>General Objective: 7.0: Know various metal joining operations.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
9	7.1 Fabricate metal container by Knock-up joining 7.2 Join metals by the grooving technique 7.3 Carry out soft soldering	• Ask students the various metal joining operations • Ask students to fabricate metal container by Knock-up joining • Join metals by grooving technique.	• OXY-acetylene gas welding set • Manual rolling machine • Guillotine shear • Assorted cutting snips • Bending machine/press brake.
<b>General Objective 8.0: Cut and join metals by gas welding</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
10	8.1 Assemble OXY-acetylene welding plant 8.2 Select various welding regulators, clips, blow pipe and nozzles. 8.3 Perform gas welding by various welding techniques Cut by flame cutting technique	• Ask students to distinguish between soft soldering and brazing • Ask students to carryout soft soldering exercise using appropriate soldering flux and assess • Ask students to list out all the component parts of an OXY-acetylene welding plant and identify them. • Ask students to assemble them • Ask students to identify this components and select appropriately for welding exercise and assess • Ask students the various welding techniques	• Blow lamps • Soldering iron • Soldering flux • Safety welding goggles • Oxygen gas cylinder • Acetylene gas cylinder • Regulators, clips, nozzles • Hoses, flash gas lighter • Welding nozzles

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<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 8.0: Cut and join metals by gas welding</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
		<ul style="list-style-type: none"> <li>• Ask students to perform gas welding using the various techniques</li> <li>• Ask students to adjust the flame appropriately for cutting</li> </ul>	<ul style="list-style-type: none"> <li>• Gas welding set</li> <li>• Chipping hammer</li> <li>• Wire brush</li> <li>• Flame cutting blow pipe (nozzle)</li> <li>• Gas welding set</li> </ul>
<b>General Objective 9.0: Know various metal arc welding operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11	9.1 Regulate current and determine polarity for metal arc welding 9.2 Determine polarity and select current 9.3 Perform various arc-welding joints by down and up and hand operation. 9.4 Select and prepare metal edges for various thickness and technique welding	<ul style="list-style-type: none"> <li>• Ask students to determine polarity for metal arc welding and regulate current.</li> <li>• Ask students to distinguish between down welding and up welding operation</li> <li>• Perform down and up welding operation</li> <li>• Ask students to prepare appropriate metal edges for various metal thickness</li> </ul>	<ul style="list-style-type: none"> <li>• Electric arc welding</li> <li>• Machine</li> <li>• Face shield</li> <li>• Welding table</li> <li>• Welding chipping hammer</li> <li>• Wire brush</li> <li>• Hand gloves</li> <li>• Leather apron's</li> <li>• Hand grinder</li> <li>• Pedestal grinding machine</li> </ul>
<b>General Objective 10.0: Employ various techniques for controlling distortion in welding operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13	10.1 Apply correctly the stop back and skip method of controlling distortion 10.2 Apply pre and post heating technique	<ul style="list-style-type: none"> <li>• Ask students to distinguish between stop back and skip method of controlling distortion in welding.</li> <li>• Apply these methods in welding exercise and compare the results.</li> <li>• Ask students to distinguish between pre and post heating techniques in controlling distortion in welding operation</li> <li>• Ask students to state what materials require pre and post heating when welding.</li> <li>• Ask students to apply this technique in</li> </ul>	<ul style="list-style-type: none"> <li>• Electric arc welding machine</li> <li>• OXY-acetylene welding plant</li> </ul>

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<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 10.0: Employ various techniques for controlling distortion in welding operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
		welding exercises.	
<b>General Objective 11.0: Know the various wood working tools and operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
14	<p>11.1 List and state the applications of the following</p> <ol style="list-style-type: none"> <li>1. Geometric /marking out tools e.g. try square, dividers and gauges.</li> <li>2. Planing tools e.g. jack, smooth, try planes, spoke shaves etc.</li> <li>3. Cutting tools, e.g. saws, chisels, knives, boring tools.</li> <li>4. Impelling tools e.g. hammers and mallets.</li> <li>5. Pneumatic tools.</li> </ol> <p>11.2 Mark out and prepare wood to give using the tools in 11.1</p> <p>11.3 Maintain all tools in 11.1</p> <p>11.4 Carry out various wood work operations using the</p>	<ul style="list-style-type: none"> <li>• Ask students to list and state the applications of this tools (a) - (e)</li> <li>• Ask students to mark out and prepare wood to using tools in 11.1 on a practical exercise</li> <li>• Ask students to maintain tools in 11.1 using appropriate materials and tools.</li> <li>• Ask students to use the tools in 11.4 for the operations on an exercise or training model</li> </ul>	<ul style="list-style-type: none"> <li>• Try square</li> <li>• Dividers</li> <li>• Gauges</li> <li>• Jack plane</li> <li>• Smooth plane</li> <li>• Try plane</li> <li>• Panel saws</li> <li>• Chisels</li> <li>• Knives</li> <li>• Boring tools</li> <li>• Hammers</li> <li>• Mallets</li> <li>• Oil stone</li> <li>• Bench/table grinder</li> <li>• Oil can</li> <li>• Portable saw</li> <li>• Portable planner</li> <li>• Portable drill</li> <li>• Portable sander</li> <li>• Jig saw</li> </ul>

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<b>Theoretical Content: PRACTICAL CONTENT</b>			
<b>General Objective 11.0: Know the various wood working tools and operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	tools in 11.4		
<b>General Objective 12.0: Know simple operations on plastics</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
15	12.1 Describe various types of plastic groups such as thermo-setting and thermo-plastic 12.2 Use conventional metal cutting tools to perform operations on each type in 12.1 12.3 Carry out joining operations using plastics in 12.1 12.4 Review previous activities and assess students.	<ul style="list-style-type: none"> <li>• Ask students to distinguish between thermo-setting and thermo-plastic.</li> <li>• Ask students the characteristics of each type.</li> <li>• Ask students to use conventional metal cutting tools for operation on thermo-setting and thermo-setting plastic. What is the result of each operation ?</li> <li>• Ask students to join the thermo-setting and thermo-plastic.</li> </ul>	<ul style="list-style-type: none"> <li>• Set of drill</li> <li>• Wood turning lathe</li> <li>• HSS cutting tools</li> <li>• Evostic glue</li> </ul>
<b>ASSESSMENT:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of Semester Examination score.			

# Machine tools Technology and Practice

MEC 124 MACHINE TOOLS TECHNOLOGY AND PRACTICE YI/2<sup>ND</sup> SEM 1/0/2 Hrs/Wk

## OUTCOME:

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

1. Understand cutting action in machining operation.
2. Understand the importance of cutting fluid in machining operation.
3. Know various types of lathes, their functions and operations.
4. Understand the features, functions and uses of shaping machines.
5. Understand the features, functions and uses of milling machines.
6. Know the features, functions and uses of grinding machines.
7. Understand and apply sheet metal work techniques.

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<b>COURSE: MACHINE TOOLS TECHNOLOGY &amp; PRACTICE</b>		<b>Course Code: MEC 124</b>	<b>Contact Hours: 6 Hrs Per/WK</b>
<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective: 1.0: Understand cutting action in machining Operation</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1	1.1 Explain the theory of metal cutting 1.2 Define forces acting at a tool point 1.3 Sketch a diagram of forces acting at tool point 1.4 Relate the tool angles to cutting efficiency 1.5 List the types of chip for motion 1.6 Sketch diagram for 1.4 1.7 List factors affecting 1.5	<ul style="list-style-type: none"> <li>• Ask students to explain the theory of metal cutting</li> <li>• Ask students to list forces acting at and tool point</li> <li>• Ask students to draw a diagram of forces acting at tool point</li> <li>• Ask students to name the types of chips that may be formed</li> <li>• Ask students to list factors affecting the types of chips that may be formed in cutting</li> </ul>	
<b>General Objective 2.0: Understand the importance of cutting fluids in machining operation</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
2	2.1 Explain how heat is generated during cutting 2.2 List common types of cutting fluid 2.3 State functions of cutting fluid	<ul style="list-style-type: none"> <li>• Ask students to explain the function of cutting fluids in machining operation.</li> <li>• Ask students to cut metal bars</li> </ul>	<ul style="list-style-type: none"> <li>• Power saw cooling suds.</li> <li>• Mild steel bars</li> </ul>



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<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 2.0: Understand the importance of cutting fluids in machining operation</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	2.4 Outline the characteristics of cutting fluid 2.5 Identify cutting fluids used for machining different materials	with and without cooling fluid to show the effect of the fluid	
<b>General Objective 3.0: Appreciate the importance of cutting tool materials</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
3	3.1 Out line the properties of cutting tools materials 3.2 List common types of cutting tools. 3.3 Outline constituents in 3.2 3.4 Select cutting tools for various machine operations	<ul style="list-style-type: none"> <li>• Ask students to list properties of cutting tools.</li> <li>• Ask students to list types of cutting tools and state the materials from which they are made.</li> <li>• Ask students to select cutting tools for some machining operations e.g turning or shaping. And assess.</li> </ul>	
<b>General Objective 4.0: Know various types of lathes and their functions</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4	4.1 Describe main types of lathes (such as capstan, turret, centre and bench lathes) and their accessories 4.2 Identify the various lathe types in 4.1 above 4.3 Describe the different operations that could be carried out on the lathe 4.4 Identify any attachment necessary for the various operations on the lathe 4.5 List the safety precautions necessary while working on the lathe machine 4.6 List the various methods of carrying out various operations e.g. taper turning, set screw cutting.	<ul style="list-style-type: none"> <li>• Ask students to identify the main lathe types</li> <li>• Ask students to sketch any type of lathe.</li> <li>• Ask students to turn some mild steel bars.</li> <li>• Ask students to turn tapers on mild steel bars</li> <li>• Ask students to take all precautions for safety during machining operations</li> </ul>	• bars.

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<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 5.0: Know various machining operations on the centre lathe</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5	5.1 Perform the following using centre lathe <ol style="list-style-type: none"> <li>1. facing operation</li> <li>2. Cylindrical turning</li> <li>3. step turning</li> <li>4. taper turning</li> <li>5. drilling</li> <li>6. boring</li> <li>7. parting</li> <li>8. knurling</li> <li>9. reaming</li> </ol> 5.2 Carry out thread cutting operations on the lathe 5.3 Carry out exercises involving operations in 5.1 and 5.2	<ul style="list-style-type: none"> <li>• Ask students to turn a mild steel bar to various diameter</li> <li>• Ask students to turn steps and tapers</li> <li>• Ask students to use lathe for boring, parting, knurling, reaming.</li> <li>• Ask students to cut threads on mild steel bars.</li> <li>• See figure 4 for example and assess</li> </ul>	<ul style="list-style-type: none"> <li>• Mild steel bars and lathe machine</li> <li>• Assorted cutting tools</li> <li>• Cutting fluid</li> </ul>
<b>General Objectives 6.0: Understand the features, functions and uses of shaping machines.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
6	6.1 Describe the main features of shaping machines 6.2 Describe how to adjust the length and position of the stroke of the shaping machine. 6.3 Describe the table feed on a shaping machine 6.4 Explain how to set ht e clapper box of a given operation. 6.5 List the advantages of a swan-necked tool on a shaping machine 6.6 Describe the methods of how to set up work-pieces on the shaping machine 6.7 Identify appropriate shaping tools for different surface forms.	<ul style="list-style-type: none"> <li>• Ask students to list the features of shaping machines.</li> <li>• Ask students to carry out the adjustment of length and position of the stroke of a shaping machine</li> <li>• Ask students to carry out shaping operations on mild steel.</li> <li>• Ask students to cut various surface forms with different shaping tools</li> </ul>	<ul style="list-style-type: none"> <li>• Shaping machine.</li> <li>• Assorted tools and Accessories.</li> <li>• Mild steel.</li> </ul>

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<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 7.0: Know shaping operations on shaping machines.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	7.1 Perform simple operations on a shaping machine 7.2 Cut key-way, slots etc, on shaping machines. 7.3 Select the correct work holding devices for different operations on the shaping machine. 7.4 Select appropriate tools for different shaping operations	<ul style="list-style-type: none"> <li>• Ask students to carry out simple shaping operations</li> <li>• Ask students to use shaping machines for slots and key-ways.</li> <li>Assess</li> </ul>	
<b>General Objective 8.0: Understand the feature, function and uses of milling machines.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
7	8.1 Describe the main features of milling machines 8.2 Describe how to mount cutters on the milling machine 8.3 Describe the various work piece and cutter holding devices and attachments used on the milling machine 8.4 List and state the use of different types of milling cutters, e.g. arbor cutters - plain cutters, shank cutters - and mills, T-slot side and mill cutters etc. 8.5 Describe the features and working principle of the dividing head. 8.6 Explain various methods of indexing e.g. direct, simple, differential, angular indexing. 8.7 Identify cutters according to materials to be milled and type of milling operations	<ul style="list-style-type: none"> <li>• Ask student to identify various cutters used in milling machines</li> <li>• Ask students to select tools and carry out milling operations e.g. surface milling.</li> <li>• Ask students to choose cutters for the milling of mild steel, brass or high carbon steel</li> </ul>	<ul style="list-style-type: none"> <li>• Milling machine,</li> <li>• Assorted cutters including arbor, plain shank etc.</li> <li>• Dividing Head, Brass, Mild steel, High Carbon Steel.</li> </ul>
<b>General Objective 9.0: Understand milling operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8	9.1 Define feed and cutting speed as applied to milling and state factors which influence cutting speed determination for milling work,	<ul style="list-style-type: none"> <li>• Ask students to explain feed and cutting speed.</li> <li>• Ask students to explain</li> </ul>	

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<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 9.0: Understand milling operations</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	e.g. material to be cut, use of coolant, type of finish etc. 9.2 Determine cutting speeds and feeds for a given milling work. 9.3 Out line the safety and operational precautions to be observed when milling 9.4 Describe up and down milling 9.5 Describe straddle and gang milling 9.6 Describe the various features of the tool and cutter grinder	relationship between feed and cutting speed. • Ask students to carry out some milling operations while taking all necessary safety precautions	
<b>General Objective 10.0: Demonstrate skills in the use of milling machines</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
9	10.1 Select and mount different types of cutters for appropriate jobs. 10.2 Select and use various types of work and cutter holding devices for different types of jobs. 10.3 Perform milling exercises using the dividing head and index plates. 10.4 Carry out milling using the following methods: (i) Up milling (ii) Down milling (iii) Gang milling 10.5 Use tool grinder to sharpen milling cutters.	• Ask students to carry out various type of milling jobs with different type of cutters. • Ask students to carry out up milling, down milling and gang milling. • Ask students to do many milling exercises using dividing head and index plates.	• Assorted Cutter, Dividing head, Index plates.
<b>General Objective 11.0: Understand the features and functions of grinding machines</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
10	11.1 Describe different types of grinding machines. 11.2 Identify the main features of grinding machines in 11.1 11.3 Describe the structure of grinding wheels.	• Ask students to name and identify in the workshop, different types of grinding machines • Ask students to select appropriate grinding wheels for	• Grinding machines Assorted grinding wheels.

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY</b>			
<b>COURSE: MACHINE TOOLS TECHNOLOGY &amp; PRACTICE</b>		<b>Course Code: MEC 124</b>	<b>Contact Hours: 6 Hrs Per/WK</b>
<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 11.0: Understand the features and functions of grinding machines</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	11.4 Identify wheels for grinding different types of materials.	different types of grinding machines.	
<b>General Objective 12.0: Know the uses of grinding machines.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
10	12.1 Explain the surface grinding operation 12.2 Explain taper grinding operation 12.3 Explain tool and cutter grinding 12.4 Explain centreless grinding 12.5 Describe gauge grinding	<ul style="list-style-type: none"> <li>• Ask students to carry out surface, taper, tool and cutter, and centreless</li> <li>• Ask students to describe gauge grinding</li> </ul>	
<b>General Objective 13.0: Understand testing, mounting, balancing, alignment and trueing of grinding wheels.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11	13.1 Explain wheel testing and mounting 13.2 Explain wheel balancing and alignment. 13.3 Describe wheel dressing and trueing.	<ul style="list-style-type: none"> <li>• Ask students to explain wheel testing and mounting.</li> <li>• Ask students to explain wheel balancing and alignment as well as wheel dressing and trueing.</li> </ul>	
<b>General Objective 14.0: Demonstrate skills in the use of grinding machines.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
12	14.1 Select work holding devices and use them on grinding machine 14.2 Carry out different types of grinding operation 14.3 Select the appropriate shapes, types and sizes of grinding wheels for various applications	<ul style="list-style-type: none"> <li>• Ask students to sharpen cutters</li> </ul>	
<b>General Objective 15.0: Demonstrate skills in wheel grinding, trueing and dressing</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13	15.1 Balance grinding wheel. 15.2 Carry out wheel trueing and dressing 15.3 Perform grinding exercise involving surface cylindrical, taper, tool, crank shaft and		

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY</b>			
<b>COURSE: MACHINE TOOLS TECHNOLOGY &amp; PRACTICE</b>		<b>Course Code: MEC 124</b>	<b>Contact Hours: 6 Hrs Per/WK</b>
<b>Course Specification: Theoretical /Practical Contents</b>			
<b>General Objective 15.0: Demonstrate skills in wheel grinding, trueing and dressing</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13	internal grinding.		
<b>General Objective 16.0: Understand and apply sheet metal work techniques</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
14 - 15	16.1 Carry out cutting operations 16.2 Carry out bending operations 16.3 Carry out Rolling operations	<ul style="list-style-type: none"> <li>• Ask the students to carry out cutting, bending and rolling of sheet metal</li> <li>• Ask the students to develop graphically and produce from sheet metal a vessel with spout that intersect e.g. oil can, watering can, kettle etc Assess.</li> </ul>	
<b>ASSESSMENT:</b> The practical class will be awarded 40% of the total score. The continuous assessment, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of the Semester Examination score.			

# DRAWING COURSES

## Technical Drawing

MEC 111 TECHNICAL DRAWING YI/1<sup>ST</sup> SEM 0/0/4 Hrs/WK

**OUTCOMES:**

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

1. Know different drawing instruments, equipment and materials used in technical drawing.
2. Know graphical communication.
3. Know the construction of simple geometrical figures and shapes.
4. Know Isometric and Oblique Projections.
5. Know single orthographic projections.
6. Understand the interactions of regular solids.

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1	1.1 Identify the different types of drawing instruments, equipment and materials. 1.2 Outline the uses of the various instruments, equipment and materials. 1.3 State the precautions necessary to preserve items 1.1 above. 1.4 Use each of the items in 1.1 above. 1.5 Maintain the various instruments and equipment.	<ul style="list-style-type: none"> <li>• Present the students all drawing instruments:</li> <li style="padding-left: 20px;">a. Drawing set</li> <li style="padding-left: 20px;">b. T-Square</li> <li style="padding-left: 20px;">c. Drawing board</li> <li style="padding-left: 20px;">d. Set squares</li> <li style="padding-left: 20px;">e. Types of pencils (H to B)</li> <li style="padding-left: 20px;">f. Show to demonstrate and explain the uses of all of the above.</li> </ul>	<ul style="list-style-type: none"> <li>• Black board ruler (1m)</li> <li>• Black board Tee-Square</li> <li>• Black board compass</li> <li>• Blackboard protector</li> <li>• Adjustable set-square</li> <li>• 60 set square</li> </ul>

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1			<ul style="list-style-type: none"> <li>• 45 set square</li> <li>• French curve set</li> <li>• Templates</li> <li>• Duster</li> <li>• Chalk</li> <li>• Complete drawing table</li> </ul>
<b>General Objective 2.0: Know Graphical Communication</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
2	2.1 Explain graphics and the different types of graphic present 2.2 Illustrate the various convention present in graphical productions of construction lines, finished lines, hidden and overhead details projections, centre lines, break lines, dimensioning of plane, elevation and sections of objects.	<ul style="list-style-type: none"> <li>• Ask the students to illustrate in a drawing the various types of lines based on BS 308 1972 Part 2. and assess.</li> <li>• Ask the students to set drawing area on A1 paper with a title block and the boarder lines and assess.</li> </ul>	- do -
3	2.3 Layout of drawing sheets with the following (a) Margins (b) Title block etc. 2.4 State the various standards of drawing sheets. 2.5 Print letters and figures of various forms and characters. 2.6 Illustrate conventional signs, symbols and appropriate lettering characters.	<ul style="list-style-type: none"> <li>• Ask students to illustrate technical lettering in capital and small letters, using, free hand and using letter stencils and assess.</li> <li>• Ask students to identify the various standard sheets Ao -A4 and assess</li> <li>• Ask students to draw conventional signs and symbols</li> <li>• and assess</li> </ul>	



<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 3.0 Know the construction of simple geometrical figures and shapes.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4	3.1 Explain the purpose of geometrical construction in drawing parallel. 3.2 Construct parallel and perpendicular lines 3.3 Construct and bisect lines, angles and areas 3.4 Divide a straight line into given number of equal parts.	<ul style="list-style-type: none"> <li>• Ask students to illustrate the construction of simple geometrical figures and shapes and assess</li> <li>• Ask students to construct parallel and perpendicular lines and assess</li> <li>• Ask students to construct and bisect lines, angles and areas and assess</li> <li>• Ask students to divide a straight line into a graph number of equal parts using the compasses and assess</li> </ul>	
	3.5 Identify polygons (regular or irregular) 3.6 Construct regular polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners 3.7 Define a circle 3.8 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.	<ul style="list-style-type: none"> <li>• Ask students to differentiate between regular and irregular polygons and assess</li> <li>• Ask students to construct regular polygon with N side</li> <li>• and assess</li> <li>• Ask students to differentiate between regular and irregular polygons and assess</li> <li>• Ask students to construct regular polygon with N-sides</li> <li>• and assess</li> </ul>	
<b>General Objective 4.0: Know the construction of simple geometrical figures and shapes.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5	4.1 Carry out simple geometrical constructions on circles e.g. (a) diameter of a circle of a circle of a given circumference. (b) the circumference to a circle of a given diameter (c) a circle to pass through 3 points (d) a circle to pass through 2	Ask students to explain the various properties of a circle and assess	- do -

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Know the construction of simple geometrical figures and shapes.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5	points and touch a given line (e) a circle to touch a given smaller circle and a given line (f) tangents to circles at various points (g) an arc of radius tangent to two lines at an angle to less than and more than 90 (h) an are externally tangent to two circles (i) inscribing and circumscribing circles		
6	4.2 Define an ellipse 4.3 Construct ellipse by using (a) trammal method (b) concentric circle method. 4.4 Explain the following draughting techniques (a) Projection method (b) Measurement method (c) Transposition method. 4.5 Construct plane scales and diagonal scales, using appropriate instruments.	<ul style="list-style-type: none"> <li>• Ask students to differentiate the different methods of constructing ellipses and assess</li> <li>• Ask students to construct an ellipse using the various methods and assess</li> <li>• Ask students to explain the various draughting techniques and assess</li> <li>• Ask students to construct plane and diagonal scales</li> <li>• and assess.</li> </ul>	
<b>General Objective 5.0: Know Isometric and Oblique Projections.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
7	5.1 Explain isometric and oblique projections.	<ul style="list-style-type: none"> <li>• Ask students to differentiate between Isometric and oblique projections and assess</li> <li>• Ask students to construct a square and circle in isometric and oblique projections and assess</li> <li>• Ask students to draw a polygon in isometric and oblique projections and assess</li> <li>• Ask students to construct and dimension holes circles, arcs and angles in isometric and oblique projection and label with appropriate conventional symbols and</li> </ul>	
8	5.2 Draw a square in isometric and oblique forms 5.3 Draw a circle in Isometric and oblique forms		
9	5.4 Draw an ellipse in Isometric and oblique forms. 5.5 Draw a polygon with a minimum of eight sides in Isometric and oblique forms		
10	5.6 Dimension holes, circles, arcs and angles correctly on isometric and obliques. 5.7 Use appropriate convention symbols and abbreviations.		

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 5.0: Know Isometric and Oblique Projections.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
		abbreviations and assess	
<b>General Objective 6.0: Know single orthographic projections.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 12	6.1 Explain the principle of orthographic projection. 6.2 Illustrate the principle planes of projection (a) Vertical plane (b) Horizontal plane . 6.3 Explain why the first and third angles are used and the second and fourth angles not used. 6.4 Project views of three-dimensional objects on to the basic planes of projection in both first and third angle to obtain (a) the front view or elevation (b) the top view or plan.	<ul style="list-style-type: none"> <li>• Ask students to differentiate between first and third angle orthographic projection and assess</li> <li>• Ask students to explain the vertical and horizontal planes in orthographic projection and assess</li> <li>• Ask students to construct orthographic projections of simple objects in first and third angle orthographic projections and assess</li> </ul>	
<b>General Objective: 7.0 Understand the intersections of regular solids.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13 - 15	7.1 Explain interpretation or intersections of solids. 7.2 Draw the lines of intersections of the following regular solids and planes in both first and third angles. <ul style="list-style-type: none"> <li>a. Two square-prisms meeting at right angles.</li> <li>b. Two dissimilar square prisms meeting at an angle.</li> <li>c. Two dissimilar square prisms meeting to an angle</li> <li>d. A hexagonal prism meeting a square prism at right</li> <li>e. angles.</li> <li>f. Two dissimilar cylinders meeting at an angle.</li> <li>g. Two dissimilar cylinders meeting</li> </ul>	<ul style="list-style-type: none"> <li>• Ask students to give examples of intersection of solids</li> <li>• Ask students to construct: <ul style="list-style-type: none"> <li>• Two square-prisms meeting at right angles <ul style="list-style-type: none"> <li>a. Two dissimilar square prisms meeting at "</li> <li>b. Two dissimilar square prisms meeting 60</li> <li>c. An hexagonal prism meeting a square prism</li> <li>d. Two dissimilar cylinders meeting at</li> </ul> </li> </ul> </li> </ul>	

<b>PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING</b>			
<b>COURSE: TECHNICAL DRAWING</b>		<b>Course Code: MEC 111</b>	<b>Contact Hours: 60 hrs.</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 7.0 Understand the intersections of regular solids.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13 - 15	at right angle, their centres not being in the same vertical plane.	an angle e. Two disjoint cylinders meeting at right angle, then centres at long in the same vertical place. f. As in 6.2	
<b>ASSESSMENT:</b> The continuous assessments, tests and quizzes will be awarded 40%, while the remaining 60% will be for the end of the Semester Examination Score.			

# Electrical Graphics

EEC111 ELECTRICAL GRAPHICS PRACTICAL Y1/1st SEMESTER 1/0/3 hrs/wk

**Objectives:**

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

1. Read and interpret Electrical and Electronic drawings.
2. Draw Electrical Installation, machines, and electronic circuits using standard symbols.
3. Use a computer package to do simple computer graphics.

<b>COURSE: ELECTRICAL GRAPHICS COURSE</b>	<b>CODE: EEC111</b>	<b>CONTACT HOUR: 15 HRS LECTURE 45 HRS TUT.</b>	
<b>Course Specification : Theoretical Content</b>			
<b>General Objective: Interpret and draw electrical and electronics diagrams using symbols and software.</b>			
Week	Specific Learning Outcome:	Teacher's activities	Resources
1 - 3	1.1 Identify and draw electrical and electronic symbols for	<ul style="list-style-type: none"> <li>• Try and obtain samples of all the components identified by the list to show the students and circulate round the class.</li> <li>• Obtain copies of relevant drawings to give to students for each section of the course.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboards, Textbooks, Templates, Drawing Materials and equipment, Computer Systems.</li> </ul>
4 - 5	a. Machines		
	b. Wiring diagrams with codes		
6 - 7	c. Switch gear, fuses, relays etc.		
	d. Voltage sources and current sources.		
8 - 9	e. Semi-conductor devices.		
10 - 11	f. Integrated chips of the 74 series		
12	g. Resistors, Capacitors, Inductors, Transformers.		
13 - 15	1.2 Practice, read and interpret Electrical, Building and Electronic diagrams.		
	1.3 Distinguish between SYMBOLIC and COMPONENT diagrams.		
	1.4 Practice, draw Symbolic Electrical circuits as used in text books.		
	1.5 Practice drawing Building wiring diagrams showing all components, wiring, conduits, switch boxes, wall plugs.		
	1.6 Practise translating drawings of "Electrical		

<b>COURSE: ELECTRICAL GRAPHICS COURSE</b>		<b>CODE: EEC111</b>	<b>CONTACT HOUR: 15 HRS LECTURE 45 HRS TUT.</b>
<b>Course Specification : Theoretical Content</b>			
<b>General Objective: Interpret and draw electrical and electronics diagrams using symbols and software.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's activities</b>	<b>Resources</b>
13 - 15	<p>Power experiments" from the symbolic diagrams to wiring diagrams showing terminals and earth points and how " 2 input Oscilloscopes" should be connected without shorting the circuit</p> <p>1.7 Examine component layout on the diagram.</p> <p>1.8 Practise drawing Electronic circuit diagrams using different semi-conductor components and Integrated chip components.</p> <p>1.9 If computers are available practice using some drawing package, even if only the drawing component of "Microsoft WORD".</p>		
<b>ASSESSMENT:</b> The Practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score.			

# Electrical Installation of Building

EEC 129 ELECTRICAL INSTALLATION OF BUILDING Y1/2<sup>ND</sup> SEM 1/0/2 HRS/WK

## OUTCOMES:

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

1. Identify and draw electrical/electronic graphical symbols.
2. Know and draft various wiring diagrams
3. Draft and interpret various architectural drawings and symbols.
4. Know different sizes and applications of cables
5. Understand installation of various electrical/electronic systems

<b>Course: WORKSHOP EXERCISES ON ELECTRICAL INSTALLATION OF BUILDING</b>		<b>Course Code: EEC 129</b>	<b>Contact Hours: 15 Hrs Lecture</b>		
<b>Course Specification: Practical</b>					
<b>General Objective: Draw and produce various installation diagrams for domestic, industrial and commercial purposes.</b>					
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>		
1	1.1 Draw electrical/electronic graphical symbols	<ul style="list-style-type: none"> <li>• The teacher should give assignments to students and assess them</li> </ul>	<ul style="list-style-type: none"> <li>• Graphical symbol, charts, drawing sets</li> </ul>		
2 - 3	1.2 Draft various electrical/electronic schematic diagrams				
4 - 5	1.3 Draft various electrical installation/wiring diagrams				
6 - 7	1.4 Draft architectural drawings of simple buildings e.g. 3-bedroom flat etc				
8 - 9	1.5 Produce elevation drawings for architectural drawings				
10 - 11	1.6 Draft electrical services for a residential building e.g. 3-bedroom flat				
12 - 13	1.7 Draft electrical supply for a 3-bedroom building				
14 - 15	1.8 Draw the installation diagram for a single phase and three-phase energy meters in domestic and commercial/industrial premises.				
<b>Assessment: The Practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score while the remaining 50 % will be for the end of the semester examination score</b>					

<b>Course: ELECTRICAL INSTALLATION OF BUILDING</b>		<b>Course Code: EEC 129</b>	<b>Contact Hours: 15 hrs lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic knowledge and skill in electrical installation of building and systems.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	<p>Graphic symbols</p> <p>1.1 Identify electrical/electronic graphical symbols</p> <ul style="list-style-type: none"> <li>a. Resistor</li> <li>b. Capacitor</li> <li>c. Inductor</li> <li>d. Diodes</li> <li>e. Thyristor</li> <li>f. Diac</li> <li>g. Triac</li> <li>h. Operational Amplifier</li> <li>i. Logic gates</li> <li>j. Linear IC</li> <li>k. Power Switches</li> <li>l. Sockets</li> <li>m. Isolator Switch</li> <li>n. Breakers</li> <li>o. Motors</li> <li>p. Fans</li> <li>q. ELCB.</li> </ul> <p>1.2 Draw symbols in 1.1 above using appropriate instruments.</p>	<ul style="list-style-type: none"> <li>• The teacher should show and draw electrical/electronic graphical symbols to the students.</li> </ul>	<p>Charts showing graphical symbols must be available in the laboratory.</p>
3  4 - 5	<p>Schematic and Wiring Diagrams</p> <p>2.1 Explain schematic and Wiring Diagrams</p> <p>2.2 State the merits and demerits of schematic diagrams</p> <p>2.3 Draft various schematic diagrams e.g Transistor circuits panel etc.</p> <p>2.4 Explain wiring diagram</p> <p>2.5 State the merits and demerits of wiring diagrams</p> <p>2.6 Draft various wiring diagrams.</p> <p>2.7 Explain methods of preventing hazards.</p>	<ul style="list-style-type: none"> <li>• The teacher should draft various schematic diagram for electrical/electronic circuits and panel to the students.</li> <li>• Teacher to draft various wiring diagrams to students</li> </ul>	<ul style="list-style-type: none"> <li>• Drawing Instrument and drawing boards.</li> <li>• Typical samples of architectural drawings must be available in the Lab. and workshop.</li> </ul>



<b>Course: ELECTRICAL INSTALLATION OF BUILDING</b>		<b>Course Code: EEC 129</b>	<b>Contact Hours: 15 hrs lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic knowledge and skill in electrical installation of building and systems.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 5	<p>2.8 Define earth continuity conductor, earth electrode, consumer's earth terminal.</p> <p>2.9 Explain the necessity for earthing and state the relevant regulations concerning earthing.</p> <p>2.10 Explain the protection of an installation by fuse and by ELCB.</p> <p>2.11 Distinguish between solid earthing practice and earth leakage circuit breaker protection.</p> <p>2.12 State a number of problems associated with earth leakage circuit breakers.</p> <p>2.13 Describe how the human body can become part of an electric circuit.</p> <p>2.14 Explain how to prevent electric shock.</p> <p>2.15 Explain methods of treating electric shock.</p> <p>2.16 Explain artificial respiration</p> <p style="padding-left: 20px;">a) mouth resuscitation</p> <p style="padding-left: 20px;">b) revised Holger Nelson resuscitation</p> <p style="padding-left: 20px;">c) external cardio compression/cardio-pulmonary resuscitation.</p>		
6 - 7	<p>Sectional and Architectural Drawing</p> <p>3.1 Explain architectural drawings and symbols</p> <p>3.2 Interpret architectural drawings</p> <p>3.3 Draft architectural drawings of simple buildings e.g 3 bedroom flat</p> <p>3.4 Produce elevation drawings from architectural drawings.</p>	<ul style="list-style-type: none"> <li>• Teacher to draft architectural drawings of simple building e.g. 3-bedroom flat.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk and Board.</li> </ul>
8 - 10	<p>Cable Sizes</p> <p>4.1 Define the following diversity factor ambient temperature, class of excess current protection, and disposition of cable</p> <p>4.2 Explain the use of relevant IEE tables for</p>	<ul style="list-style-type: none"> <li>• The teacher should show to the student various cable sizes used in wiring and services building.</li> <li>• Draw typical electrical supply</li> </ul>	<ul style="list-style-type: none"> <li>• Films</li> <li>• Computers to aid drafting. (Auto CAD)</li> </ul>

<b>Course: ELECTRICAL INSTALLATION OF BUILDING</b>		<b>Course Code: EEC 129</b>	<b>Contact Hours: 15 hrs lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic knowledge and skill in electrical installation of building and systems.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8 - 10	<p>cable selection.</p> <p>4.3 Apply 4.1 and 4.2 for close selection</p> <p>4.4 Design an external supply system for a 3-bedroom building</p> <p>4.5 Draft electrical services for a simple 3-bedroom building</p> <p>4.6 Calculate the total load current for a final sub circuit in the building</p> <p>4.7 List the main types of insulating and conducting materials.</p> <p>4.8 Distinguish between conductors and insulators.</p> <p>4.9 Describe, with the aid of sketches, the construction of different types of cables.</p> <p>4.10 State the advantages and disadvantages when using:</p> <ul style="list-style-type: none"> <li>a. PVE - Insulated, PVC - sheathed cables.</li> <li>b. Mineral - Insulated metal - sheathed cables</li> <li>c. Armoured PVC - insulated, PVC - sheathed cables</li> <li>d. Steel and PVC conducts</li> <li>e. Steel and PVC trunking.</li> <li>f. Flexible cabled and cord etc.</li> </ul> <p>4.11 Explain the general I.E.E. Regulation related to cables and their uses.</p> <p>4.12 Identify the cable colour coding, commonly used in Nigeria.</p> <p>4.13 Demonstrate various types of joints using PVC and flexible cables.</p>	systems for building.	
11 - 12	<p>Estimating Procedure</p> <p>5.1 Produce item quantities from drawings</p> <p>5.2 Assess cost of materials</p>	<ul style="list-style-type: none"> <li>• Prepare typical bills of quantities for electrical installations.</li> </ul>	

<b>Course: ELECTRICAL INSTALLATION OF BUILDING</b>		<b>Course Code: EEC 129</b>	<b>Contact Hours: 15 hrs lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 1.0 Understand the basic knowledge and skill in electrical installation of building and systems.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 12	5.3 Prepare typical bills of engineering measurements and materials for an electrical installation.	• Give students practices and mark them.	
13 - 15	Electronic/Electrical Systems Installation 6.1 Install Public address system 6.2 Install Tv system 6.3 Install computer system 6.4 Install Electrical services of residential and commercial/industrial premises 6.5 Install single phase and three-phase energy meters in domestic and commercial/industrial premises.	• The teacher should illustrate the installation of the system with appropriate diagram and procedure.	• Samples of installation diagrams.
<b>Assessment:</b> The Practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score while the remaining 50 % will be for the end of the semester examination score			

# MEASUREMENT/INSTRUMENT COURSES

## Electrical/Electronics Instrumentation I

EEC 126 ELECTRICAL/ELECTRONIC INSTRUMENTS | Y1/2<sup>ND</sup> SEMESTER 1/0/3 HRS/WK

### OUTCOME:

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

1. Identify various types of electrical and electronic instruments.
2. Understand different types of error in measurement.
3. Know the features, functions and uses of moving coil instruments.
4. Know the operation of bridge circuits
5. Understand the working principle and construction of ohmmeter and megger.

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS</b>		<b>Course Code: EEC 126</b>	<b>Contact Hours: 1/0/3 hrs</b>
<b>Course Specification : Theoretical Content</b>			
<b>General Objective 1.0: Understand the basic knowledge and skill in measurement and measuring instruments</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	<p>1.1 List various types of Electrical and Electronic Measurement Instruments:</p> <ul style="list-style-type: none"> <li>a. Moving iron</li> <li>b. Moving Coil</li> <li>c. Voltmeter</li> <li>d. Ammeter</li> <li>e. Cathode ray Oscilloscope (C.R.O.)</li> <li>f. Megger</li> <li>g. Wheatstone bridge</li> <li>h. Wattmeter</li> <li>i. Digital Voltmeter</li> <li>j. Frequency Counters</li> <li>k. Clip ammeter etc.</li> </ul> <p>1.2 Identify the instruments listed in 1.1 above</p> <p>1.3 State the applications of the instruments listed in 1.1 above</p> <p>1.4 State the range of type of each where necessary.</p>	<ul style="list-style-type: none"> <li>• Ask students to identify the items in section 1.1</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard, Textbooks, Measuring Instruments</li> </ul>

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS</b>		<b>Course Code: EEC 126</b>	<b>Contact Hours: 1/0/3 hrs</b>
<b>Course Specification : Theoretical Content</b>			
<b>General Objective 1.0: Understand the basic knowledge and skill in measurement and measuring instruments</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
3 - 4	2.1 State different types of errors <ul style="list-style-type: none"> <li>a. Random</li> <li>b. Systematic</li> <li>c. Static</li> </ul> 2.2 Define the errors Stated in 2.1 above. 2.3 Give practical examples of the errors stated in 2.1 above.	<ul style="list-style-type: none"> <li>• State the types of errors in practical examples</li> </ul>	-do-
5 - 7	3.1 Sketch the permanent magnet moving Coil Instrument 3.2 Explain the operation of moving Coil Instrument 3.3 Show how the moving Coil Instrument can be used as <ul style="list-style-type: none"> <li>a. Ammeter and</li> <li>b. Voltmeter.</li> </ul> 3.4 Show how a multiplier and Shunt can be used to increase the range of Voltmeter and ammeter respectively. 3.5 Calculate the Values of the multiplier and shunt. 3.6 Calibrate a moving Coil Instrument. 3.7 Measure Voltage and Current by connecting Multiplier and Shunt respectively.	<ul style="list-style-type: none"> <li>• Illustrate the operating principle with diagram(s)</li> </ul>	-do-
8 - 10	4.1 Draw a block diagram of the following Digital Meters: <ul style="list-style-type: none"> <li>a. Digital Voltmeter</li> <li>b. Frequency Counter</li> </ul> 4.2 Explain the operation of the instruments in 4.1 above. 4.3 Use DVM to measure Voltage 4.4 Use Frequency Counter to measure frequencies up to 100KHz	<ul style="list-style-type: none"> <li>• Give the essential features of Digital Instrument</li> </ul>	-do-

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS</b>		<b>Course Code: EEC 126</b>	<b>Contact Hours: 1/0/3 hrs</b>
<b>Course Specification : Theoretical Content</b>			
<b>General Objective 1.0: Understand the basic knowledge and skill in measurement and measuring instruments</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 13	5.1 List various types of bridge Circuit <ul style="list-style-type: none"> <li>a. Wheat Stone,</li> <li>b. Capacitance</li> <li>c. Inductance.</li> </ul> 5.2 State the industrial applications of the bridges listed in 5.1 above.           5.3 Explain the operation of the bridge circuits listed in 5.1 above.           5.4 Explain the operation of a null detector           5.5 Use Wheatstone bridge to measure resistance.	<ul style="list-style-type: none"> <li>• Ask students to explain the operation and applications of bridge circuits</li> </ul>	-do-
14 - 15	6.1 Sketch the diagram of Ohmmeter and Megger           6.2 Describe the Construction and Operation of the instruments in 6.1 above           6.3 Identify an earth point           6.4 Use Megger to Measure the following: <ul style="list-style-type: none"> <li>a. Earth resistance and</li> <li>b. Insulation resistance.</li> </ul>	<ul style="list-style-type: none"> <li>• Ask students to state the differences Ohmmeter and Megger</li> </ul>	-do-
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS I</b>		<b>Course Code: EEC 126</b>	<b>Contact Hours: 45 hrs Practical</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective 1.0 Utilize and measure electrical quantities with electrical/electronic instruments</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	1.1 Demonstrate ohm's law using variable resistance 1.2 Demonstrate ohm's law using variable e.m.f	• Ask students to verify ohm's law	• e.m.f sources, variable and fixed resistances, cables, voltmeter, ammeter
3 - 5	2.1 Determine the resistivity of materials 2.2 Determine the resistance of serial and parallel circuit 2.3 Verification of Kirchoff's current and voltage law 2.4 Demonstrate superposition theory	• Ask students to compare their results with the theory of experiment	-do-
6 - 7	3.1 Demonstrate charging and discharging of capacitors 3.2 Demonstrate charging and discharging of inductors	• The teacher should assist to charge and discharge the circuit elements	• Capacitors, inductor, e.m.f sources, voltmeter and ammeter
8 - 10	4.1 Calibrate and measure with moving coil instruments 4.2 Calibrate and measure with moving iron instrument	• The teacher should demonstrate the process of calibration with the students	• Moving coil instrument, moving iron instrument, drawing sets
11 - 13	5.1 Determine the resistance using wheatstone bridge 5.2 Demonstrate bridge circuits to measure a. inductance b. capacitance c. frequency	• Ask students to comment bridge circuit	• Wheatstone bridge and other bridge circuits
14 - 15	6.1 Measure d.c voltage in experiments using moving coil instrument 6.2 Measure a.c voltage in experiments using suitable instruments	• Involve the students in the measurement using suitable instruments	• A.C and d.c voltmeters

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS I</b>		<b>Course Code: EEC 126</b>	<b>Contact Hours: 45 hrs Practical</b>
<b>Course Specification: Practical tasks</b>			
	<b>General Objective 1.0 Utilize and measure electrical quantities with electrical/electronic instruments</b>		
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score		



# Electrical/Electronics Instrumentation II

EEC 236 ELECTRICAL/ELECTRONIC INSTRUMENTS II Y2/3<sup>rd</sup> semester 1/0/2 hrs/wk

## OUTCOMES:

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

1. Understand and Utilize the cathode ray oscilloscope.
2. Know the operation and utilize wattmeters
3. Understand the factors for selection of instruments.
4. Know the importance of instrumentation in industries

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS II</b>		<b>Course Code: EEC 236</b>	<b>Contact Hours: 1/0/2 hrs</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Acquaint the students with operation and application of electrical/electronic instruments for laboratory and industrial measurements</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	1.1 Draw the block diagram of CRO 1.2 Explain the function of each block 1.3 Draw the diagram of Cathode Ray Tube (CRT) 1.4 Explain the operation of C.R.T. a. CRT Vertical and horizontal amplifiers b. Time base, c. Triggering d. Sweep generator 1.5 Measure D.C. Voltage with C.R.O. 1.6 Measure the following a/c. parameters using C.R.O: a. Amplitude b. Phase and c. Frequency	• Ask the students to draw and explain the functions of CRO's block diagram	• Chalk, Board, Textbooks, Cathode ray tube, wattmeter
5 - 8	2.1 Sketch electro-dynamics Power meter 2.2 Explain the operation of the meter 2.3 Explain the use of three meters and	• The teacher should demonstrate the use of wattmeter for power measurement	-do-

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS II</b>		<b>Course Code: EEC 236</b>	<b>Contact Hours: 1/0/2 hrs</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Acquaint the students with operation and application of electrical/electronic instruments for laboratory and industrial measurements</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 8	two meters in measuring power in 3- $\Phi$ Circuit 2.4 Measure Power in Single phase Circuit 2.5 Measure Power in 3- $\Phi$ Circuit 2.6 Calculate Power factor.		
9 - 10	3.1 Explain the importance of the following factors in selecting measurement instruments: a. Range b. Accuracy c. Response d. Stability e. Reliability f. Sensitivity	• Ask the students to explain the fabric in selecting measurement instruments	• Chalk and board
11 - 15	4.1 Explain the importance of instrument in industries 4.2 List important measurement industries a. Pressure b. Temperature c. Level d. Flowrate e. Density f. Viscosity g. Humidity, etc. 4.3 Explain why the variables in 4.2 above are important. 4.4 Classify instruments into the following: a. Indicating b. Recording c. Controlling 4.5 Give examples of each in 4.3 above	• The teachers should emphasize on all the industrial measurements and instruments' classification	- do-

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS II</b>		<b>Course Code: EEC 236</b>	<b>Contact Hours: 1/0/2 hrs</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Acquaint the students with operation and application of electrical/electronic instruments for laboratory and industrial measurements</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 15	4.6 State the applications of Instruments in 4.3 above.		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS II</b>		<b>Course Code: EEC 236</b>	<b>Contact Hours: 30hrs Practicals</b>
<b>Course Specification Practical tasks</b>			
<b>General Objective : Apply the electrical/electronic instruments for measuring electrical and physical quantities</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 5	1.1 Measurement of d.c voltage in experiments using CRO 1.2 Measurement of a.c voltage in experiments using CRO 1.3 Measurement of range of frequencies with CRO 1.4 Measurement of phase angles with CRO	• Ask students to take measurements during experiments	• CRO, signal generator, d.c/a.c power supplies, probe
6 - 9	2.1 Carry out experiment on d.c power measurement 2.2 Perform experiment on a.c power measurement in single phase circuit 2.3 Carry out experiment on a.c power measurement in three phase circuit 2.4 Perform experiment on power factor measurement	• The teacher should involve the students in power measurement	• Wattmeter, power supplies, single and three phase circuits
10 - 15	3.1 Perform experiment to determine temperature effect on resistance 3.2 Carry out experiment to verify temperature effect on semi conductor	• Give students experiments to perform with necessary guidance	• Resistances, semi-conductor diodes, digital thermometers, power supplies, cables

<b>Course: ELECTRICAL/ELECTRONIC INSTRUMENTS II</b>		<b>Course Code: EEC 236</b>	<b>Contact Hours: 30hrs Practicals</b>
<b>Course Specification Practical tasks</b>			
	<b>General Objective : Apply the electrical/electronic instruments for measuring electrical and physical quantities</b>		
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
10 - 15	diode 3.3 Measure temperature range using digital thermometer		
	<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score		

# ELECTRICAL ENGINEERING COURSES

## Electric Power I

EEC 122 ELECTRICAL POWER I Y1/2<sup>nd</sup> SEM 1/0/2 HRS/WK

### OUTCOMES

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

1. The principles of generation of electrical energy
2. The principles of distribution of electrical power
3. The methods used for protection of electrical power systems.

<b>Course: ELECTRICAL POWER I</b>		<b>Course Code: EEC 122</b>	<b>Contact Hours: 15hrs Lecture; 30hrs Practicals</b>
<b>Course Specification: Theoretical content and Practical (Industrial visit)</b>			
<b>General Objective 1.0: The principles of generation of electrical energy</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
1 - 3	1.1 Describe with the aid of lay out diagrams the operation of; <ol style="list-style-type: none"> <li>a. Steam plant</li> <li>b. Diesel plant</li> <li>c. Gas plant</li> <li>d. Solar and wind plant.</li> </ol> 1.2 Be able to draw a general layout for generation transmission and distribution of electrical power systems.	<ul style="list-style-type: none"> <li>• Instructor should use photographs extensively in describing some installations.</li> <li>• A site visit would also help in getting a realistic impression of the generators/alternator set.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, industrial visits, samples of the available equipment and materials</li> </ul>
4 - 6	1.3 Differentiate between transmission and distribution. 1.4 State the various voltage levels between the generating station and the consumer 1.5 Distinguish between short and medium transmission lines. 1.6 Explain the principles of protection system. 1.7 State types of conductors and	<ul style="list-style-type: none"> <li>• A plan of the Nigerian Grid would be useful to provide the students with an idea how power reaches their homes.</li> <li>• Atypical house load diagram over 24hrs period should be compared with a load diagram from a small industrial unit.</li> </ul>	

<b>Course: ELECTRICAL POWER I</b>		<b>Course Code: EEC 122</b>	<b>Contact Hours: 15hrs Lecture; 30hrs Practicals</b>
<b>Course Specification: Theoretical content and Practical (Industrial visit)</b>			
<b>General Objective 1.0: The principles of generation of electrical energy</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
	sizes. 1.8 Describe the construction of underground cables. 1.9 Solve problems involving simple short transmission lines.		
<b>General Objective 2.0 Understand the basic principles of distribution systems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
7 - 9	2.1 Explain the difference between distributors and feeders 2.2 Solve problems involving voltage drops in simple distribution systems.	<ul style="list-style-type: none"> <li>• Give the students the problem of estimating the power Consumption of your local town.</li> <li>• Try to identify what protection devices exist in your home town.</li> <li>• Arrange a visit to your local distribution station.</li> </ul>	
<b>General Objective: 3.0 Understand the basic principles of protection in power systems.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
10 - 13	3.1 Describe the component parts of a fuse 3.2 Explain the purpose of a fuse 3.3 Define fusing currents, current rating and fusing factor. 3.4 Describe the moulded case of a circuit breaker 3.5 Define the interruption capacity of a circuit breaker 3.6 Define an isolator 3.7 Explain the difference between a circuit breaker and an isolator	<ul style="list-style-type: none"> <li>• Get students to write short reports on such visit.</li> <li>• Show samples of different insulators obtained from your local electricity workshop.</li> </ul>	
<b>General Objective: 4.0 Understand different types of insulators and supports.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
14 - 15	4.1 Describe with the aid of diagrams, different types of insulators such as (i) post cap type (ii) pin type (iii) shackle ring	- do -	- do -

Course: ELECTRICAL POWER I		Course Code: EEC 122	Contact Hours: 15hrs Lecture; 30hrs Practicals
Course Specification: Theoretical content and Practical (Industrial visit)			
General Objective: 4.0 Understand different types of insulators and supports.			
Week	Specific Learning Outcome:	Teacher's Activities	Resources
14 - 15	4.2 State the applications of the insulators in 4.1 4.3 Describe different types of insulating materials and their applications.		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

## Electric Power II

ELECTRICAL POWER II EEC 232 Y2/3<sup>RD</sup> SEMESTER 1/0/2 HRS/WK

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

1. Understand other methods of Electricity Generation
2. Understand the principles of transmission, distribution and protection
3. Understand the performance of short and medium transmission lines.

<b>Course Specification ELECTRICAL POWER II</b>		<b>Course Code: EEC 232</b>	<b>Contact Hours: 15hrs</b>
<b>Theoretical Content and Practical (Industrial Visits)</b>			<b>lecture 30hrs practicals</b>
<b>General Objective: Understand the transmission lines and cable with their performances</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 5	1.1 Describe with the aid of diagrams the following: <ol style="list-style-type: none"> <li>a. hydro electricity generation</li> <li>b. Nuclear generation</li> <li>c. MHD generation</li> </ol> 1.2 Explain factors affecting the choice of site for items in 1.1 1.3 Explain the advantages and disadvantages of power plant in 1.1 1.4 Draw a typical layout diagram for a power system. 1.5 Identify major items in a power system layout. 1.6 Describe the National Electric Power Grid system as applicable to National Electricity Power Authority (NEPA). 1.7 Identify the types of generators that are commonly used for peak and base loads. 1.8 Solve problems on load factor, peak and base load costs per unit. 1.9 Draw typical load curves	<ul style="list-style-type: none"> <li>• A site visit will be required to understand layout diagram of power system</li> <li>• A plan of the Nigerian Grid would assist the students to comprehend the national grid system</li> <li>• Give the students the problem of estimating the load factor, peak and load demand</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, industrial visits, samples of available equipment and materials</li> </ul>
6 - 10	2.1 Describe various types of poles, pole supports towers and state their uses. 2.2 Explain the line surveying and route	<ul style="list-style-type: none"> <li>• Teachers should describe the poles, towers, conductors, underground cables</li> </ul>	-do-



<b>Course Specification ELECTRICAL POWER II</b>		<b>Course Code: EEC 232</b>	<b>Contact Hours: 15hrs lecture 30hrs practicals</b>
<b>Theoretical Content and Practical (Industrial Visits)</b>			
<b>General Objective: Understand the transmission lines and cable with their performances</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
6 - 10	profile 2.3 Derive expressions for resistance, inductance and capacitance for a single-phase transmission lines. 2.4 Solve problems involving short and medium transmission lines with their parameters. 2.5 Describe with the aid of diagrams, the construction of various conductors and their sizes. 2.6 Describe with the aid of diagrams the construction of various types of underground cables. a. Two core cable b. Three core cable 2.7 State the advantage of 2.6 2.8 Explain dielectric stress and ionization in cables. 2.9 Derive expression for the capacitance dielectric stress and insulation resistance of a single core cable. 2.10 State expression for the thermal resistance for single and three-core cables.	<ul style="list-style-type: none"> <li>• Solve problems involving short and medium transmission lines</li> </ul>	
11 - 15	3.1 Explain the principles of modelling of transmission lines (short and Medium lines) 3.2 Explain the concept of per unit system. 3.3 Derive expressions for per unit power, voltage, current and impedance 3.4 Solve problems involving per unit in 3.3. 3.5 Define voltage at the sending and	<ul style="list-style-type: none"> <li>• Ask the students to model transmission lines.</li> <li>• Solve problems involving per unit system</li> <li>• Give problems involving phasor and appropriate equivalent diagrams of transmission network</li> </ul>	-do-

Course Specification ELECTRICAL POWER II Theoretical Content and Practical (Industrial Visits)		Course Code: EEC 232	Contact Hours: 15hrs lecture 30hrs practicals
General Objective: Understand the transmission lines and cable with their performances			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11 - 15	receiving end of the line. 3.6 Draw phasor diagram for short transmission line. 3.7 Solve problems in short transmission for voltage drop, voltage regulation, transmission efficiency and copper used 3.8 Draw the approximate equivalent diagrams for nominal $\Pi$ (Pi) and nominal (T) net works. 3.9 Evaluate ABCD parameters for 3 - 7 3.10 Draw phasor diagrams for nominal $\Pi$ (Pi) or nominal T net work systems.		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

# Electric Power III

ELECTRICAL POWER III EEC 242 Y2/4TH SEMESTER 1/0/2HRS/WK

## General Objectives

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

1. Understand the interconnected in electrical power engineering
2. Understand the performance of fault analysis in interconnected systems.
3. Describe the system over voltages and insulation requirements
4. Understand various types of substations and substation equipment.
5. Understand the principles of operation of protection systems and their applications.

<b>Course ELECTRICAL POWER III Course Specification: Theoretical Content</b>		<b>Course Code: EEC 242</b>	<b>Contact Hours: 15hrs lecture</b>
<b>General Objective: Understand the performance of load flow and fault analysis of interconnected power systems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
1 - 4	1.1 Discuss interconnected power systems 1.2 State the advantages and disadvantages of interconnected power systems 1.3 Construct the power circle diagram. 1.4 Describe the techniques for reducing interconnected systems to simple equivalent diagrams. 1.5 Solve problems involving 1 - 4 above 1.6 Explain the need for load flow studies. 1.7 Explain the advantages and disadvantages of load flow studies. 1.8 Formulate the nodal admittance matrices for various net work. 1.9 State the various variables (P, Q, S, V and $\phi$ ) affecting the load flow in power system next work. 1.10 Classify the variables in 1.8 into control independent and dependent variables.	<ul style="list-style-type: none"> <li>• The teacher should indicate the essence of load flow analysis to power systems</li> <li>• Ask the students to solve problems on load flow analysis</li> <li>• Show how digital computer can be applied to this analysis</li> <li>• Give written computer program to perform load flow analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, digital computer, samples of application software on load flow analysis</li> </ul>

<b>Course ELECTRICAL POWER III Course</b>		<b>Course Code: EEC 242</b>	<b>Contact Hours: 15hrs</b>
<b>Specification: Theoretical Content</b>			<b>lecture</b>
<b>General Objective: Understand the performance of load flow and fault analysis of interconnected power systems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
1 - 4	<p>1.11 Derive the general form of the load flow equation in</p> <p style="padding-left: 40px;">a. Rectangular form</p> <p style="padding-left: 40px;">b. Polar form</p> <p>1.12 Know one method of load flow solution (Gaus Seidel)</p> <p>1.13 Solve problems on load flow analysis for interconnected system.</p> <p>1.14 Explain the application of digital computers to load flow studies.</p> <p>1.15 Write a computer programme to perform load flow analysis of a simple power network.</p> <p>1.16 Execute item 1.16 using a computer.</p>		
6 - 9	<p>2.1 Describe various types of faults that can occur on generators transformers and transmission lines.</p> <p>2.2 Explain short circuit, open circuit and earth faults on transmission lines.</p> <p>2.3 Define transient and sub-transient reactances.</p> <p>2.4 Explain sub-transient and transient reactances using the appropriate wave form of a faulted generator.</p> <p>2.5 Draw typical wave forms of short circuit currents in power systems.</p> <p>2.6 Explain a symmetrical fault.</p> <p>2.7 Solve symmetrical fault problems using one line diagram and the per unit system method.</p> <p>2.8 Derive expressions for the symmetrical components for positive, negative and zero sequence in terms of the line values.</p>	<ul style="list-style-type: none"> <li>• The teacher should be able to describe different types of faults on generators, transformers and transmission lines</li> <li>• Help the students to determine fault levels on typical power systems</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk,, board and Textbooks</li> </ul>

<b>Course ELECTRICAL POWER III Course</b>		<b>Course Code: EEC 242</b>	<b>Contact Hours: 15hrs</b>
<b>Specification: Theoretical Content</b>			<b>lecture</b>
<b>General Objective: Understand the performance of load flow and fault analysis of interconnected power systems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
6 - 9	<p>2.9 State the expression for power in symmetrical component.</p> <p>2.10 Define unsymmetrical (asymmetrical) faults for</p> <ul style="list-style-type: none"> <li>a. Single-line to ground</li> <li>b. Double-line to ground</li> <li>c. Line - to - line.</li> </ul> <p>2.11 Explain unsymmetrical fault problems using the symmetrical component networks.</p> <p>2.12 Identify the sequence impedances of power system components.</p> <p>2.13 Determine the sequence network for a given power system.</p> <p>2.14 Solve unsymmetrical fault problems using the principles of symmetrical components.</p> <p>2.15 Determine the MVA fault level on typical power systems.</p> <p>2.16 Describe methods of selecting circuit breakers, switch gears bus-bars, fuses for typical fault levels.</p>		

<b>Course ELECTRICAL POWER III Course</b>		<b>Course Code: EEC 242</b>	<b>Contact Hours: 15hrs</b>
<b>Specification: Theoretical Content</b>			<b>lecture</b>
<b>General Objective: Understand the performance of load flow and fault analysis of interconnected power systems</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
6 - 9	<p>3.1 Describe corona effect and the factors affecting it.</p> <p>3.2 Derive an expression for the disruptive critical voltages for an overhead line.</p> <p>3.3 Explain the causes of over voltage in power systems.</p> <p>3.4 Draw a typical surge wave-form.</p> <p>3.5 State the possible effects of a travelling wave on transmission line.</p> <p>3.6 Derive an equation for surge velocity in a uniform transmission line.</p> <p>3.7 Use the expression in 3.6 to solve involving surge velocity in a</p> <p style="padding-left: 20px;">a. Single phase line</p> <p style="padding-left: 20px;">b. Three phase line</p> <p style="padding-left: 20px;">c. Single - phase concentric cable.</p> <p>3.8 Derive an expression for surge impedance (<math>Z_0</math>)</p> <p>3.9 Explain different types of terminations</p> <p>3.10 Derive an expression for reflected surge voltage and current.</p> <p>3.11 Define</p> <p style="padding-left: 20px;">a. Reflecting factor coefficient (<math>\rho</math>)</p> <p style="padding-left: 20px;">b. Transmission factor coefficient (<math>t</math>)</p> <p>3.12 Solve problems involving 3.8, 3.10 and 3.11.</p>	<ul style="list-style-type: none"> <li>• Ask the students to identify the causes of over-voltage in power systems</li> <li>• Derive expressions for the characteristics of transmission line</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, boards, textbooks</li> </ul>

Course ELECTRICAL POWER III Course Specification: Theoretical Content		Course Code: EEC 242	Contact Hours: 15hrs lecture
General Objective: Understand the performance of load flow and fault analysis of interconnected power systems			
Week	Specific Learning Outcome:	Teacher Activities	Resources
	<p>3.13 Describe the protection of transmission lines against possible lightning surges.</p> <p>3.14 Draw graphs for voltage and current surges when R is less than <math>Z_o</math> (<math>R &lt; Z_o</math>) and explain the graph.</p> <p>3.15 Explain the effect of a surge on an over-head terminated by a transformer.</p> <p>3.16 Deduce expressions for reflected voltage and current surges in an open circuited and short-circuited line.</p>		
10 - 15	<p>3.17 Solve problems involving reflected voltages and currents surges in 3.16.</p> <p>3.18 Explain various types of overhead line insulators and their applications.</p> <p>3.19 Describe various types of overhead insulators and state their applications.</p> <p>3.20 Describe various methods of testing insulators.</p> <p>3.21 Derive expressions for voltage distribution and efficiency across an insulating string (string efficiency).</p> <p>3.22 Solve problems on voltage distribution and string efficiency using the expressions in 3.21.</p> <p>3.23 Describe insulation co-ordination in overhead lines.</p> <p>3.24 Explain the principles of operation of an impulse generator</p>	<ul style="list-style-type: none"> <li>The teachers should describe various overload insulators including their application, testing and efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Chalk, board, textbooks</li> </ul>
<p><b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score</p>			

<b>Course: ELECTRICAL POWER III</b>		<b>Course Code: EEC 242</b>	<b>Contact Hours: 30hrs Practicals</b>
<b>Course Specification: Practical Tasks</b>			
<b>General Objective : Analysis and Troubleshoot of faults on a typical power system</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Activities</b>	<b>Resources</b>
1 - 4	1.1 Determine the sending and receiving end voltage of the line 1.2 Determine the voltage regulation and transmission efficiency	• Ask students to carryout the practical as demonstrated	• Transmission line model, ammeter, voltmeter and wattmeter
5 - 8	2.1 Write computer program to perform load flow analysis of a simple power network	-do-	• Computer systems and C++ software package
9 - 12	3.1 Identify the faults on faulted generators, transformers and T-line 3.2 Determine the symmetrical and unsymmetrical faults in a power system	-do-	• Wattmeter, voltmeter, ammeter, phase sequence meter, stroboscope
13 - 15	4.1 Demonstrate methods of testing insulators 4.2 Perform experiment to determine voltage distribution and string efficiency	-do-	• Megger, voltmeter and ammeter
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			



# Electric Machines I

EEC 122- ELECTRICAL MACHINE 1 Y1/2<sup>ND</sup> SEMESTER 1/0/2HRS/WK

**OUTCOMES:**

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

1. Understand the construction, principle of operation, characteristics and application of dc machine
2. Understand the basic principles of a transformer and application
3. Understand the construction, principles of operation and application of Ac machines.

<b>Course: ELECTRICAL MACHINE I</b>	<b>Course Code: EEC 123</b>	<b>Contact Hours: 15 hrs Lecture</b>	
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Understand the construction and principle of operation of d.c, a.c machines and transformers</b>			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 5	1. Describe, with the aid of a labelled diagram, the construction of a dc motor. 1.2 State materials used in the Construction of various parts dc machines. 1.3 State the functions of armature windings and field windings 1.4 Show the student a typical lap & wave winding of a dc machine 1.5 Differentiate between lap and wave windings 1.6 Draw diagrams of Lap and wave windings 1.7 Derive emf equation of dc machine 1.8 Solve problems involving 1.4 and 1.6 1.9 State factors that affect the emf equations 1.10 Derive the equation $V=E+I_a R_a$ (for a motor) Or $E = V + IR$ (for a generator) 1.11 Explain, with the aid of developed diagram, armature reaction and methods	<ul style="list-style-type: none"> <li>• The teacher should give the detail construction of d.c machines</li> <li>• Ask the students to solve problems on d.c machines</li> <li>• Explain the conditions for parallel operation of d.c machines</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, d.c machines</li> </ul>

<b>Course: ELECTRICAL MACHINE I</b>		<b>Course Code: EEC 123</b>	<b>Contact Hours: 15 hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Understand the construction and principle of operation of d.c, a.c machines and transformers</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 5	<p>of minimising it.</p> <p>1.12 Stop circuit representations of dc machines and calculate current and voltage drop.</p> <p>1.13 Explain Concept of back emf.</p> <p>1.14 Explain the need for Starters for a dc motor.</p> <p>1.15 Describe different Starters for dc motors.</p> <p>1.16 Derive the condition for maximum efficiency of dc machine.</p> <p>1.17 State conditions for parallel operation of dc machines.</p> <p>1.18 Solve problems involving 1.15 to 1.17</p>		
6 - 10	<p>2.1 Describe with Labelled diagrams the construction and principles of operation of Single phase transformer</p> <p>2.2 List different types of cores used in transformer construction</p> <p>2.3 Explain with the aid of phasor diagrams the action of a transformer on load and on no-load</p> <p>2.4 Derive transformation equations of a transformer.</p> <p>2.5 Draw an equivalent circuit for a transformer</p> <p>2.6 Describe with the aid of an equivalent circuit, a practical transformer.</p> <p>2.7 Determine the equivalent circuit of a transformer with parameters referred to the primary or secondary.</p> <p>2.8 List standard terminal markings for a</p>	<ul style="list-style-type: none"> <li>• The teacher should ensure that the construction and operation of transformer is illustrated with diagrams</li> <li>• Ask the students to solve problems associated with single phase and three phase transformers</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, single and three phase transformers</li> </ul>

<b>Course: ELECTRICAL MACHINE I</b>		<b>Course Code: EEC 123</b>	<b>Contact Hours: 15 hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Understand the construction and principle of operation of d.c, a.c machines and transformers</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
6 - 10	<p>single, 2-phase, and 3-phase transformers as governed by BS171.</p> <p>2.9 Define efficiency of transformers.</p> <p>2.10 Calculate efficiency of a transformers</p> <p>2.11 Derive the expression for maximum efficiency of a transformer (Single and 3-phase)</p> <p>2.12 Solve problems involving 2.3 to 2.11</p> <p>2.13 Explain the principles of operation of an auto transformer.</p> <p>2.14 Describe the construction of a 3-phase transformer</p> <p>2.15 State transformer applications</p> <p>2.16 State various cooling arrangements used in practical 3- phase transformer.</p>		
11 - 15	<p>3.1 Discuss how rotating field are produced and how polyphase machines are constructed (use diagrams</p> <p>3.2 Differentiate between synchronous and Induction machines.</p> <p>3.3 Describe the Component parts of a 3-phase Induction motor (Squirrel cage and wound type)</p> <p>3.4 Explain the principles of operation of Induction machine.</p> <p>3.5 Define Synchronous speed and slip.</p> <p>3.6 Solve problems relating to 3.4 and 3.5</p> <p>3.7 List the component parts of an Alternator</p> <p>3.8 Derive the e.m.f equations of an Alternator</p>	<ul style="list-style-type: none"> <li>• The teacher should discuss the principles of operation of induction and synchronous machine</li> <li>• Give simple problems involving a.c machines</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks and a.c machines</li> </ul>

<b>Course: ELECTRICAL MACHINE I</b>		<b>Course Code: EEC 123</b>	<b>Contact Hours: 15 hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective : Understand the construction and principle of operation of d.c, a.c machines and transformers</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
11 - 15	3.9 Explain the principle of operation of a single phase Induction motor 3.10 Calculate efficiency of an Induction motor 3.11 Derive an expression for maximum efficiency of an Induction motor 3.12 Explain various applications of an Induction machine 3.13 Solve simple problems involving ac machines. 3.14 Explain the various types of enclosures and cooling arrangements of electrical machines (dc motors and ac motors)		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

## Electric Machines II

<b>Course: ELECTRICAL MACHINES II</b>		<b>Course Code: ECC 233</b>	<b>Contact Hours: 15 Hrs Lectures</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the fundamental principles of electrical machines:</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	<p>1.1 State the principles of induction, interaction and alignment as applied to electrical machines.</p> <p>1.2 Explain with the aid of sketches how the principles are applied to electrical machines.</p>	<ul style="list-style-type: none"> <li>• Explain with diagrams the principle and operation of inductions motors.</li> <li>• Take students to the machine laboratory and show them the construction of an electrical motors.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard, Chalk, textbooks, electrical machines</li> </ul>
<b>General Objective 2.0: Understand the the principles of electro-mechanical energy conversion</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
3 - 8	<p>2.1 State the major energy conversion principles.</p> <p>2.2 Derive the general energy balance equation applicable to all situations.</p> <p>2.3 Represent by suitable block diagrams the energy balance equation.</p> <p>2.4 Derive induced voltage and electrical energy input in singly excited systems.</p> <p>2.5 Derive the energy in the magnetic field of a singly excited system.</p> <p>2.6 Derive the mechanical force in the system in 2.5 above.</p> <p>2.7 Derive energy balance equation.</p> <p>2.8 Develop the dynamic equation of singly excited electro-mechanical system.</p> <p>2.9 Solve problems involving 2.2 to 2.7 above.</p> <p>2.10 Perform an experiment to show the conversion of energy in singly excited systems.</p>	<ul style="list-style-type: none"> <li>• Explain to the students, the principles of synchronous machines.</li> <li>• Indicate the types of synchronous machines.</li> <li>• Explain the basic difference between motors and generator</li> <li>• Take students to the machine laboratory to see practical generators.</li> <li>• Demonstrate the difference between the types of generators by diagram.</li> </ul>	-do-

<b>Course: ELECTRICAL MACHINES II</b>		<b>Course Code: ECC 233</b>	<b>Contact Hours: 15 Hrs Lectures</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 3.0: Know the principles of operation and construction of transformers</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
9 - 10	<p>3.1 Explain the working principle of the transformers.</p> <p>3.2 Develop the emf equation of a transformer.</p> <p>3.3 Describe the different types of transformer cores and windings.</p> <p>3.4 Explain resultant flux, magnetizing inductance, leakage fluxes and leakage inductances.</p> <p>3.5 Explain the phasor diagrams for transformer on no-load and on-load.</p> <p>3.6 Explain the equivalent circuit of a transformer.</p> <p>3.7 Identify the limitations of the equivalent circuit and the approximate equivalent circuit.</p> <p>3.8 Use the open-circuit test and the short-circuit test to determine the equivalent circuit parameters.</p> <p>3.9 Describe methods of testing transformers namely:</p> <p>3.10 Connect three single phase transformers for three phase operation (i.e. Star/Star, Star/Delta)</p> <p>3.11 Show with the aid of sketches the possible arrangement of three transformer windings.</p> <p>3.12 Group transformers into their vector groups</p> <p>3.13 Explain the use of each group and their advantages.</p> <p>3.14 Explain the purpose of the tertiary windings in three phase transformers.</p> <p>3.15 Explain the parallel operation of</p>	<ul style="list-style-type: none"> <li>• Explain to the student the working principle, types and equivalent circuit of transformers.</li> <li>• Solve problems on transformer</li> <li>• Teachers should demonstrate possible arrangements of the transformer windings to provide single phase and poly-phase transformer.</li> <li>• Give the detail of parallel operation of three-phase transformer</li> </ul>	- do -

Course: ELECTRICAL MACHINES II		Course Code: ECC 233	Contact Hours: 15 Hrs Lectures
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 - 10	three phase transformers. 3.16 Derive expression for load sharing of transformers connected in parallel.		
11 - 14	3.17 Describe methods of testing transformers namely: a. Specialised investigation on particular details of design, performance and operation after manufacture b. Acceptance test c. Routine test during life span of the transformer 3.18 Differentiate between power and distribution transformers. 3.19 Explain the effects of temperature rise on transformers. 3.20 Describe methods of cooling transformers. 3.21 Explain the limitation of each method	• Teacher should operate and test a transformer	- do -
15	3.22 Explain the source of vibration and noise in transformers. 3.23 Explain voltage control by tap changing. 3.24 Explain the causes of harmonics in transformers. 3.25 Solve related problems involving 3.2 - 3.24.		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

<b>Course: ELECTRICAL MACHINES II</b>		<b>Course Code: ECC 233</b>	<b>Contact Hours: 30 hrs - Practicals</b>
<b>Course Specification: Practicals tasks</b>			
<b>General Objective : 1.0 Experiment the fundamental principles of electrical machines</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 19	1.1 Perform experiment on open circuit characteristics of a single phase transformer 1.2 Perform experiment on open circuit characteristics of three phase transformer 1.3 Carryout experiment on close circuit characteristics of a single phase transformer 1.4 Perform experiment on close circuit characteristics of three phase transformer 1.5 Perform experiment on identifying polarity of a 3-phase transformer	<ul style="list-style-type: none"> <li>• Teacher should assist the students when carrying out experiment</li> </ul>	<ul style="list-style-type: none"> <li>• Transformers (single and three phase), a.c machines, starters, voltmeter, ammeter, tachometer, phase sequence meter</li> </ul>
10 - 15	2.1 Perform experiments on open and close circuit characteristics of a single induction motor 2.2 Carryout experiments on open and close circuit characteristics of a three phase induction motion 2.3 Carryout experiment on open circuit characteristics of an alternator/a.c generator	<ul style="list-style-type: none"> <li>• Teacher should assist the students when carrying out experiments</li> </ul>	-do-
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessment, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of the semester score			



# Electrical Engineering Science I

EEC 115 ELECTRICAL ENGINEERING SCIENCE I Y1/1<sup>ST</sup> SEMESTER 1/0/2 HRS/WK

## OUTCOMES:

On completion of the module, the students should be able:

1. Understand the concept of the electric current flow.
2. Understand simple d.c circuits.
3. Know various types of energy and their inter-relationships.
4. Understand the concept of electrostatics, electric charge and capacitance of capacitor.

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNIQUES</b>			
<b>Course: ELECTRICAL ENGINEERING SCIENCE I</b>		<b>Course Code: EEC 115</b>	<b>Contact Hours: 15 Hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the concept of electric current flow</b>			
Week	Specific Learning Outcome:	Teacher Activities	Resources
1 - 3	1.1 Define an atom 1.2 Explain the structure and composition of an atom 1.3 Differentiate between conductors, insulators and semi-conductors. 1.4 Explain the concepts of current and electron flow 1.5 Define electric current, potential difference electromotive force (e.m.f) and resistance, state their units and symbols. 1.6 State multiples and sub-multiples of Electric quantities; (e.g. Mega $10^6$ , kilo- $10^3$ , etc)	<ul style="list-style-type: none"> <li>• Draw atomic structure to explain to the student its composition.</li> <li>• Explain the electron mobility</li> <li>• Draw the atomic structure to explain the unique differences in their structure.</li> <li>• Explain with the aid of diagrams how the current &amp; electron flow.</li> <li>• Write down the formulae and symbols for current flow, p.d. or e.m.f., resistance.</li> <li>• Explain them to the students.</li> <li>• Explain quantities of electricity and their units.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk Board, Chalk,</li> <li>Textbook,</li> <li>Charts</li> </ul>
<b>General Objective 2.0: Understand simple dc circuits</b>			
Week	Specific Learning Outcome:	Teacher Activities	Resources
4 - 6	2.1 Define d.c. Current 2.2 State the analogy between current flow and water flow. 2.3 Describe basic d.c. circuits 2.4 Explain Ohm's law 2.5 Verify by experiment the Ohm's law	<ul style="list-style-type: none"> <li>• State the definition of current.</li> <li>• Explain how flow of current is similar to the flow of water.</li> <li>• Draw the basic d.c circuit with source.</li> <li>• Explain the flow of current.</li> <li>• Use diagrams to explain Ohms law.</li> </ul>	

**PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNIQUES**

**Course: ELECTRICAL ENGINEERING  
SCIENCE I**

**Course Code: EEC 115**

**Contact Hours:  
15 Hrs Lecture**

**Course Specification: Theoretical Content**

**General Objective 2.0: Understand simple dc circuits**

<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
4 - 6	2.6 Solve problems using Ohm's law 2.7 Define resistivity and conductivity of a conductor. 2.8 State the relationship between resistance of a conductor, its resistivity, length and area. 2.9 Differentiate between series and parallel circuits. 2.10 Solve problems involving resistivity and conductivity 2.11 Deduce the equivalent resistance of series and parallel circuits.	<ul style="list-style-type: none"> <li>• Give some circuit with resistive components.</li> <li>• Verify Ohms laws.</li> <li>• Explain how to obtain resistivity and conductivity from the formula <math>R = \rho l/a</math></li> </ul>	
7 - 9	2.12 Explain Kirchoff's laws. 2.13 Verify by experiment the Kirchoff's laws. 2.14 Explain the Superposition Principles 2.15 Solve problems involving series and parallel circuits using Kirchoff's laws and superposition principles. 2.16 Define temperature coefficient of resistance 2.17 Use the expression for resistance at temperature $T^{\circ}k$ and to calculate change in resistance. 2.18 See from 2.18 the change in resistance due to change in temperature 2.20 Solve problems involving effect of temperature on resistance	<ul style="list-style-type: none"> <li>• Explain how to obtain resistivity from the formula <math>R = \rho l/a</math></li> <li>• Draw the circuit diagrams for series and parallel connections.</li> <li>• Explain the differences between the Kirchoff's laws and superposition principles. Give examples.</li> <li>• Explain the relationship between the temperature and resistance of a wire.</li> <li>• Show how to calculate a change in resistance when the temp changes. Explain why there is a temperature change when the current flows through a wire.</li> <li>• Show a typical graph of resistance against temperature</li> </ul> Solve problems	

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNIQUES</b>			
<b>Course: ELECTRICAL ENGINEERING SCIENCE I</b>		<b>Course Code: EEC 115</b>	<b>Contact Hours: 15 Hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 3.0: Understand various types of energy and their inter-relationships</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
10 - 12	3.1 Explain various types of energy 3.2 Explain the relationship between electrical, mechanical and thermal energy. 3.3 State 5.1 units of various types of energy in 3.2 3.4 State Joule's law 3.5 Solve problems involving Joule's law	Explain the sources of various energy generations. • Show how they are related to electrical energy • Explain their units. • Solve problems	
<b>General Objective 4.0: Understand the concept of electrostatics, electric charge and capacitance of capacitors.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
13 - 14	4.1 Explain electric charge 4.2 State its unit 4.3 State Coulomb's law 4.4 Solve problems involving coulomb's law 4.5 Define electric field strength, electric flux density, permittivity, relative permittivity, field intensity, potential and electric flux. 4.6 Solve problems involving the terms in 4.5 4.7 Define capacitance 4.8 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and permittivity of the dielectric.	• Explain sources of electric charges and electrostatic charges • Explain the mathematical formula for the electric charge, electrostatic charges. • Treat energy store in Capacitor.	
15	4.9 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and permittivity of the dielectric. 4.10 Derive an expression for the		

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNIQUES</b>			
<b>Course: ELECTRICAL ENGINEERING SCIENCE I</b>		<b>Course Code: EEC 115</b>	<b>Contact Hours: 15 Hrs Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 4.0: Understand the concept of electrostatics, electric charge and capacitance of capacitors.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher Activities</b>	<b>Resources</b>
15	capacitance of a capacitor with composite dielectrics 4.11 Derive an expression for the voltage distribution between series connected capacitors. 4.12 Deduce an expression for the equivalent capacitance for capacitors connected in series and in parallel. 4.13 Derive an expression for the energy stored in a capacitor 4.14 Solve problems involving 4.8 to 4.12.		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNIQUES			
Course: ELECTRICAL ENGINEERING SCIENCE I		Course Code: EEC 115	Contact Hours: 30 Hrs Practical
Course Specification: Practical tasks			
General Objective 1.0: Perform experiments on d.c circuits to understand electrical quantities.			
Week	Special Learning Outcome:	Teachers Activities	Resources
1 - 7	1.1 Perform experiment on a single loop d.c circuit with variable e.m.f 1.2 Verify Ohm's law 1.3 Carry out experiments on series and parallel circuits. 1.4 Verify Kirchoff's law with d.c circuits. 1.5 Verify superposition principles.	• Teachers should ensure necessary precautions are taken during the experiment.	• Resistors, capacitor, voltmeter, ammeter, ohmmeter, cable, emf sources, thermometer.
8 - 11	2.1 Determine by experiment the temperature coefficient of resistance. 2.2. Verify by experiment the heating effect .	-do-	-do-
12 - 15	3.1 Perform experiment to determine the d.c power 3.2 Verify Joules' Law 3.3 Perform experiment on charging and discharging of a capacitor.	-do-	-do-
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

## Electrical Engineering Science II

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: ELECTRICAL ENGINEERING SCIENCE II		Course Code: EEC 125	Contact Hours: 15 HRS Lecture
Course Specification: Theoretical Content			
General Objective: 1.0 Understand the concept of magnetism and magnetic circuits.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Define magnetic flux, magnetic flux density magnetic motive force, magnetic field strength, reluctance, permeability of free space (magnetic constants), relative permeability. 1.2 State the symbols, units and relationships of terms in 1.1 1.3 Draw the electrical equivalent of a magnetic circuit, with or without air-gap. 1.4 State analogies between electrical and magnetic circuits. 1.5 Solve simple magnetic circuit problems 1.6 Distinguish between soft and hard magnetic materials.	<ul style="list-style-type: none"> <li>• State the general concept of magnetism and electromagnetism</li> <li>• The teacher is to derive formulae for field strength force etc.</li> <li>• Show analogies between electrical and magnetic circuits.</li> <li>• Solve problems in the class.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk Board, textbooks, coil of conductor, magnetic materials, magnet.</li> </ul>
General Objective: 2.0 Understand the concept of electromagnetism and electromagnetic induction			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4 - 8	2.1 Explain the magnetic affect of electric current 2.2 Draw magnetic fields around straight conductors, adjacent parallel conductors and solenoids. 2.3 Explain the force on a current carrying conductor in a magnetic field. 2.4 State the direction of the force in 2.4 2.5 Derive the expression for the magnitude of the force in 2.4 (i.e. $F = BIL$ Newton) 2.6 Explain the concept of electromagnetic induction 2.7 State Faraday's Laws of electromagnetic induction 2.8 State Lenz's law of electromagnetic induction	<ul style="list-style-type: none"> <li>• The teacher to show right hand rule and explain the concept of electric field and electromagnetic Induction.</li> </ul>	-do-

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: ELECTRICAL ENGINEERING SCIENCE II</b>		<b>Course Code: EEC 125</b>	<b>Contact Hours: 15 HRS Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 2.0 Understand the concept of electromagnetism and electromagnetic induction</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 8	2.9 Derive the expressions for magnitude of e.m.f induced in a conductor or a coil. 2.10 Solve problems involving 2.6 to 2.10 above. 2.11 State the applications of electromagnetic induction.		
<b>General Objective: 3.0 Understand the concept of inductance and its applications</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
9 - 11	3.1 Define self and mutual inductance 3.2 State the symbols and units of the terms in 3.1 above 3.3 State the expression for the equivalent inductance of inductances connected in series and in parallel 3.4 State the expression for the induced voltage across an inductor 3.5 State the expression for inductance in coupled coils connected in series aiding or opposing. 3.6 Derive an expression for energy stored in an inductor 3.7 Solve problem involving 3.3 to 3.6 3.8 Describe using suitable diagram, the operation of the induction coiled in a car ignition system	<ul style="list-style-type: none"> <li>• Explain mutual inductance and how to calculate various parameters.</li> <li>• Show with examples how energy stored is.</li> </ul>	-do-
<b>General Objective: 4.0 Understand the fundamentals of a.c. theory</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
12 - 15	4.1 Describe the production of an alternating e.m.f. by a rotating coil in a magnetic field. 4.2 Sketch a.c. waveforms both to scale and not to scale. 4.3 Define r.m.s, instantaneous, average,	<ul style="list-style-type: none"> <li>• The teacher should explain in detail the theory of alternating current and voltage.</li> <li>• Solve problems on a.c circuits.</li> </ul>	-do-

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: ELECTRICAL ENGINEERING SCIENCE II</b>		<b>Course Code: EEC 125</b>	<b>Contact Hours: 15 HRS Lecture</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: 4.0 Understand the fundamentals of a.c. theory</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
12 - 15	<p>and peak values, period, and frequency of an a.c. waveform.</p> <p>4.4 State relationship between instantaneous, and peak values of a sinusoidal wave.</p> <p>4.5 Solve problems involving 4.2. to 4.4</p> <p>4.6 Solve problems graphically on a.c. circuits with different combinations of resistance, inductance and capacitance.</p> <p>4.7 Differentiate between series and parallel resonance.</p> <p>4.8 Explain phase lag or phase lead as applied to a.c. circuits.</p> <p>4.9 Explain the difference between single-phase and three-phase supply.</p> <p>4.10 State advantages and disadvantages of three phase supply over single phase supply.</p>		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			



<b>Course: ELECTRICAL ENGINEERING SCIENCE II</b>		<b>Course Code: EEC 125</b>	<b>Contact Hours: 30 HRS PRACTICAL</b>
<b>Course Specification: Practical Tasks</b>			
<b>General Objective 1.0: Understand through experiments the a.c fundamentals and circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 5	1.1 Determine by experiment the B-H curve for magnetic material (Hysterisis curve) 1.2 Perform experiment on a magnetic energy loss in a magnetic material 1.3 Verify by experiment faraday's law of electromagnetic induction 1.4 Perform experiment on Lenz's law of electromagnetic induction	• Ask students to perform the experiments with minimum error	• Magnet, inductors, voltmeter, ammeter, flux meter
6 - 10	2.1 Determine by experiment the inductance of a coil 2.2 Perform experiment to determine energy loss in an inductor 2.3 Determine by experiment energy loss in an inductor 2.4 Perform experiment on serial and parallel inductive circuit	-do-	-do-
11 - 15	3.1 Perform experiment to measure the frequency, period and amplitude of sinusoidal signal 3.2 Carryout experiment to obtain serial and parallel resonance of a.c circuit 3.3 Determine by experiment the Q-factor of a series RLC circuit 3.4 Determine by experiment the Q-factor of a parallel RLC circuit	• Teacher should differentiate between d.c circuit and a.c circuits	• Oscilloscope, signal generator, voltmeter, ammeter, resistor, inductors and capacitors
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, test and quizzes will take 10% of the total score, while the remaining 50% will be for the end of the semester examination score			

# Electric Circuit Theory I

EEC 239 ELECTRIC CIRCUIT THEORY I Y2/3 SEMESTER 1/0/2 HRS/ WEEK

## OUTCOMES:

On completion of the module, the students are expected to:

1. Understand a.c theory and apply it to the solution of simple electrical circuits.
2. Understand mesh and nodal analysis and their applications in solving electrical circuits problems
3. Understand and apply network transformation and duality principles
4. Understand network theorems and their applications to d.c and a.c circuits

<b>Course: ELECTRICAL CIRCUIT THEORY I</b>		<b>Course Code: EEC 239</b>	<b>Contact Hours: 1/0/2 HRS/WK</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective: Understand a.c theory and apply it to the solution of simple electrical circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	1.1 State different mathematical forms of representing a.c signals eg. Trigonometry, polar and j-notation. 1.2 Convert a.c signal in polar form to the j-notation. 1.3 Subtract, add, multiply and divide phasor using j-operator 1.4 Solve simple problems using j-notation 1.5 Draw to scale phasor diagrams for a.c circuits 1.6 Show with the aid of phasor diagrams that the current in a capacitor circuit leads voltage and the current in the inductive circuit lags the voltage 1.7 Distinguish between inductive and capacitive reactances 1.8 Draw voltage and current wave forms on same axis to show lagging and leading angles 1.9 Draw the phasor diagrams for series and parallel a.c circuits 1.10 Calculate voltage, current, power and	<ul style="list-style-type: none"> <li>• Teacher should explain the a.c theory with respect to serial and parallel circuit</li> <li>• Solve many problems involving a.c theory and circuits</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, charts, calculator</li> </ul>

<b>Course: ELECTRICAL CIRCUIT THEORY I</b>		<b>Course Code: EEC 239</b>	<b>Contact Hours: 1/0/2 HRS/WK</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective: Understand a.c theory and apply it to the solution of simple electrical circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	<p>power factor in series and parallel circuits</p> <p>1.11 Explain series and parallel resonance</p> <p>1.12 State conditions for series and parallel resonance</p> <p>1.13 Prove the relevant formulae for 2.12 above e.g Q-factor, dynamic impedance, bandwidth resonance frequency</p> <p>1.14 Sketch I and Z against F for series and parallel circuits where I = current, Z = impedance. F = frequency.</p> <p>1.15 Calculate the Q-factor for a coil; loss factor for a capacitor.</p> <p>1.16 Explain, with the aid of a diagram bandwidth</p> <p>1.17 Solve problems involving bandwidth and circuit Q-factor.</p>		
5 - 7	<p>2.1 Explain the following terms used in electric network:</p> <p style="padding-left: 40px;">a. ideal and practical independent current and voltage series</p> <p style="padding-left: 40px;">b. branch</p> <p style="padding-left: 40px;">c. node</p> <p style="padding-left: 40px;">d. loop</p> <p style="padding-left: 40px;">e. Network</p> <p>2.2 Explain the basic principle of mesh circuit analysis.</p> <p>2.3 Solve problem on items listed in 3.2 above</p> <p>2.4 Explain the basic principle of nodal analysis</p> <p>2.5 Solve problem on 3.4</p>	<ul style="list-style-type: none"> <li>• Ask students to solve and analysis nodal/mesh network circuits</li> </ul>	-do-
8 - 11	<p>3.1 Reduce a complex network to its series or parallel equivalent</p> <p>3.2 Identify star and delta networks</p> <p>3.3 Derive the formula for the transformation of a delta to a star network and vice versa</p>	<ul style="list-style-type: none"> <li>• Solve network problems with duality principle</li> </ul>	

<b>Course: ELECTRICAL CIRCUIT THEORY I</b>		<b>Course Code: EEC 239</b>	<b>Contact Hours: 1/0/2 HRS/WK</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective: Understand a.c theory and apply it to the solution of simple electrical circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8 - 11	3.4 Solve problems on 3.3 above 3.5 Explain the meaning of Duality principle 3.6 Establish duality between resistance, conductance inductance, capacitance, voltage-current 3.7 Find the duality of a network 3.8 Solve network problems using duality principle.		
12 - 15	4.1 State Thevenin's Theorem 4.2 Explain the basic principle of Thevenin's theorem 4.3 Solve problems on some network using Thevenin's theorem 4.4 Solve problems involving repeated use of Thevenin's theorem 4.5 State Norton's theorem 4.6 Explain the basic principle of Norton's theorem 4.7 Compare Norton's theorem with Thevenin's theorem 4.8 Solve problems using Norton's theorem 4.9 State Millman's theorem 4.10 Explain the basic principle of Millman's theorem 4.11 Solve network problems using Millman's theorem 4.12 State Reciprocity theorem 4.13 Explain the basic principle of reciprocity theorem 4.14 Solve network problems using Reciprocity theorem	<ul style="list-style-type: none"> <li>• Explain the Thevenin's and Norton's theorem to solve electric circuits/networks problems</li> <li>• Solve network problems using Millman's theorem and Reciprocity theorem</li> </ul>	-do-
<b>Assessment:</b> The continuous assessment, quizzes and tests will be awarded 40% of the local score, while the remaining 60% will be for the end of the semester examination			

## Electric Circuit Theory II

EEC 249 ELECTRIC CIRCUIT THEORY II Y2/4<sup>TH</sup> SEMESTER 1/0/2 HRS/WEEK

### OUTCOMES:

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

1. Understand the principle of power calculation in a.c circuits.
2. Understand the basic principles involved in three-phase systems and their applications
3. Understand and apply time domain analysis of RC, RL and RLC circuits
4. Understand and apply the concept of magnetic coupling

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: ELECTRIC CIRCUIT THEORY II		Course Code: EEC 249	Contact Hours: 30 HOURS
Course Specification: Theoretical Content			
<b>General Objective 1.0: Understand the principle of power calculation in a.c. circuits</b>			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Calculate power in A.C. circuits containing: <ol style="list-style-type: none"> <li>a. Resistance;</li> <li>b. Inductance;</li> <li>c. Capacitance;</li> <li>d. Combinations of (i.) - (iii)</li> </ol> 1.2 Explain power factor and factors affecting its value 1.3 Explain the following: <ol style="list-style-type: none"> <li>a. Apparent power;</li> <li>b. Reactive power;</li> <li>c. Active power.</li> </ol> 1.4 Explain methods of power factor correction 1.5 Solve problems on power factor, active power, apparent power, reactive power and power factor correction.	Show how to calculate <ol style="list-style-type: none"> <li>a. Power from a.c. circuit</li> <li>b. Explain various ways to get a.c. parameters.</li> <li>c. Discuss the use of 3 phase a.c. power.</li> <li>d. Show how to calculate various parameters in frequency domain.</li> <li>e. Explain coupling.</li> </ol>	• Chalk, board, textbooks, charts and calculator

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: ELECTRIC CIRCUIT THEORY II</b>		<b>Course Code: EEC 249</b>	<b>Contact Hours: 30 HOURS</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Understand the basic principles involved in three-phase systems and their applications.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 7	2.1 Define polyphase system 2.2 Explain the basic difference between single phase and three-phase systems. 2.3 Explain the phase sequence of a three-phase system. 2.4 State the advantages of 3-phase circuits. 2.5 Explain how 3-phase emf's are produced 2.6 Distinguish between star and delta 3-phase system. 2.7 Derive the relationship between line and phase values of voltages and current in a star and delta connected windings. 2.8 Derive an expression for power in a 3-phase circuit (balanced and unbalanced). 2.9 Explain the 2-wattmeter and single-wattmeter methods of measuring 3-phase power. 2.10 Solve problems on 2.5 to 2.9.	<ul style="list-style-type: none"> <li>• Ask the students to identify single phase, three-phase (star and delta) systems</li> <li>• Solve various problems on polyphase system</li> </ul>	-do-
<b>General Objective: 3.0 Understand and apply Time Domain analysis of RC, RL and RLC circuits.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
	3.1 Explain the meaning of transients 3.2 Sketch the growth and decay curves in RC circuits 3.3 Derive formulae for current & voltage growths and decay in RC circuits. 3.4 Define time constant 3.5 Explain time constant in RC and circuits 3.6 Derive expressions for the growth and	<ul style="list-style-type: none"> <li>• Teacher should illustrate domain analysis of RC, RL, RLC circuit with appropriate diagrams and models</li> </ul>	-do-

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: ELECTRIC CIRCUIT THEORY II		Course Code: EEC 249	Contact Hours: 30 HOURS
Course Specification: Theoretical Content			
General Objective: 3.0 Understand and apply Time Domain analysis of RC, RL and RLC circuits.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	decay of voltage and current in RL circuits. 3.7 Sketch curves for growth and decay of current and voltage in RL circuits. 3.8 Explain the need for connecting a resistor in parallel with an inductor 3.9 Derive expressions for growth and decay of current in RLC circuits. 3.10 Derive expressions for the time constant and natural frequency for RLC circuits. 3.11 Solve problems involving transients in RC., RL and RLC circuits.		
General Objective 4.0: Understand and apply magnetic coupling phenomena			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12 - 15	4.1 Describe magnetic coupling 4.2 Define mutual Inductance 4.3 Determine the polarity of coupled coils 4.4 Define coefficient of coupling 4.5 Define an equivalent circuit for magnetically coupled coils 4.6 Define an ideal transformer 4.7 Use 4.5 to derive an equivalent circuit of an ideal transformer 4.8 Explain with the aid of sketches, an equivalent circuit of a practical transformer.	<ul style="list-style-type: none"> <li>Ask the students to state applications of magnetic couplings</li> </ul>	-do-
<b>Assessment:</b> The continuous assessment, quizzes and tests will be award 40% of the total score while the remaining 60% will be for the end of semester examination score			

# ELECTRONIC/TELECOMMUNICATION COURSES

## Electronics I

EEC124 ELECTRONICS I Y1/2<sup>ND</sup> SEM 15 HOURS

**OUTCOMES:**

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

1. Appreciate the use of semiconductor devices in useful electronic applications.
2. Learn to build and test simple electronic circuits.
3. Be further motivated to learn more about how the devices work.

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: Electronics I</b>		<b>Course Code: EEC 124</b>	<b>Contact Hours: 15 HRS</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective: Understand the operating characteristics of diodes, transistor, FET's and Thyristors</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	1.1 Outline energy levels in materials and the electron as a carrier of electricity or charge. 1.2 Explain valence and conduction bands 1.3 Explain Fermi energy levels 1.4 Distinguish between conductors, semiconductors, and insulators, using Fermi-energy level concept. 1.5 Explain intrinsic and extrinsic semiconductors. 1.6 Explain carriers in semi-conductors 1.7 Define majority and minority carriers 1.8 Outline the effect of temperature on the conductivity of semi-conductors and conductors	<ul style="list-style-type: none"> <li>• The material in this module must be kept at a simple level related to bonding , agitation due to temperature and the movement of free electrons constitute a current.</li> <li>• Explain polarity convention between flow direction of charge and flow convention of current being opposite to each other.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk, board, textbooks, and lecture notes</li> </ul>
5 - 7	2.1 Identify the circuit symbols for PN junction diode. 2.2 Explain with the aid of suitable sketches the forward and reverse and	<ul style="list-style-type: none"> <li>• Power dissipation consideration must be brought in at all levels of this course even though it is not obvious.</li> </ul>	-do-



PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: Electronics I		Course Code: EEC 124	Contact Hours: 15 HRS
Course Specification: Theoretical Content			
General Objective: Understand the operating characteristics of diodes, transistor, FET's and Thyristors			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5 - 7	<p>zener characteristics of the PN junction diode.</p> <p>2.3 Explain zener diode characteristics</p> <p>2.4 Identify the circuit symbols for zener diode.</p> <p>2.5 Explain the zener effect phenomenon</p> <p>2.6 Explain the applications of zener diode (clipping, clamping, stabilization etc.)</p>		
8 - 11	<p>3.1 Explain the structure and operation of a bipolar transistor (NPN and PNP)</p> <p>3.2 Explain the biasing arrangements of NPN and PNP bipolar transistors.</p> <p>3.3 Explain the circuit configurations of NPN and PNP bipolar transistors:</p> <ul style="list-style-type: none"> <li>a. the common base configuration</li> <li>b. the common collector configuration</li> <li>c. the common emitter configuration.</li> </ul> <p>3.4 Sketch the static characteristic curves of NPN and PNP bipolar transistors for 3.3 (i.) and 3.3 (ii).</p> <p>3.5 Determine the input and output resistances, current and voltage gains from 3.4.</p>		
12 - 15	<p>4.1 Explain basic structures of the thyristor</p> <p>4.2 Explain the working principles of the thyristor.</p> <p>4.3 List sample applications of the thyristor</p>		

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: Electronics I		Course Code: EEC 124	Contact Hours: 15 HRS
Course Specification: Theoretical Content			
General Objective: Understand the operating characteristics of diodes, transistor, FET's and Thyristors			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12 - 15	4.4 State the advantages of the thyristor switch over other types of electro-mechanical switches e.g. relay.		
<b>Assessment</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: Electronics I		Course Code: EEC 124	Contact Hours: 30HRS PRACTICALS
Course Specification: Practical tasks			
General Objective: Understand and apply the operating characteristics of Semi-conductor devices			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1-15	<ol style="list-style-type: none"> <li>Determine by experiment on PN junction semi-inductor diode characteristics using silicon and germanium diode.</li> <li>Determine by experiment on the forward and reverse characteristics of a Zener diode</li> <li>Perform experiment on the application of Zener diode of a Zener diode</li> <li>Determine by experiment the static characteristics of NPN transistor in common-emitter (CE) configuration</li> <li>Perform experiment to determine the static characteristics of NPN transistor in common-emitter (CE) configuration</li> <li>Determine by experiment the static characteristic of NPN</li> </ol>	<ul style="list-style-type: none"> <li>Teacher should give instructions that will assist the students to successfully carryout the experiments</li> </ul>	<ul style="list-style-type: none"> <li>PN junction diodes, PNP and NPN transistors, thyristor, ammeter, voltmeter, Zener diode and cable</li> </ul>

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: Electronics I</b>		<b>Course Code: EEC 124</b>	<b>Contact Hours: 30HRS PRACTICALS</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Understand and apply the operating characteristics of Semi-conductor devices</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1-15	transistor in common base (CB) configuration 7. Determine by experiment the static characteristics of PNP transistor in common base (CB) configuration. 8. Determine by experiment the static characteristic of NPN transistor in common collector (CC) configuration 9. Determine by experiment the static characteristics of PNP transistor in common collector (CC) configuration. 10. Perform experiment on the voltage vs. current characteristics of a thyristor		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

# Electronics II

EEC 234 ELECTRONICS II Y2/3<sup>rd</sup> SEM 1/0/2HRS/WK

## OUTCOMES

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

1. Build and test simple electronic circuits made up of basic semi-conductor devices and used in electronic applications.
2. Understand the use of transistors in CE, CC, and CB circuits.
3. Have an understanding of Biasing, DC and AC coupling.
4. Appreciate the difference between Signal and Power amplifiers.

<b>Course: Electronics II</b>		<b>Course Code: EEC 234</b>	<b>Contact Hours: 15 HRS LECTURE</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Understand the basic semi-conductor devices and their applications in electronic circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	1.1 Explain the basic constructional features of FET's (junction gate and insulated gate).	<ul style="list-style-type: none"> <li>• Explain different types of biasing arrangement of transistor amplifiers viz:                             <ul style="list-style-type: none"> <li>a. fixed bias</li> <li>b. collector-base bias with out a decoupling capacitor</li> <li>c. potential divider bias junction FET simple bias</li> </ul> </li> <li>• Low-power amplifiers</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk , board, field effect transistors, textbooks, amplifier circuits</li> </ul>
	1.2 Plot the output and transfer characteristics from given data.		
	1.3 Determine mutual conductance and drain resistance for the device.		
	1.4 State the precautions necessary when using FET's		
3 - 7	1.5 Obtain voltage gain, input and output resistance from output characteristics.		
8 - 12	2.1 Explain dc biasing, dc & AC resistive load lines, Voltage/ Current / Power Gain of the stage for bipolar transistors and Field Effect devices.	<ul style="list-style-type: none"> <li>• Draw the circuit diagram of a single stage common emitter and common source transistor amplifiers having resistive load.</li> <li>• Repeat for transformer Loads, and show effect on load line.</li> </ul>	
13 - 15	2.2 Explain the AC equivalent circuit of a transistor in each configuration.	<ul style="list-style-type: none"> <li>• Draw equivalent circuits of amplifiers in CC, CE, CB mode.</li> </ul>	
	2.3 Calculate the Voltage, Current & Power Gain of the stage	<ul style="list-style-type: none"> <li>• Calculate the voltage and power gains of the amplifiers for given data</li> </ul>	
	3.1 Explain the application and		

<b>Course: Electronics II</b>		<b>Course Code: EEC 234</b>	<b>Contact Hours: 15 HRS LECTURE</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Understand the basic semi-conductor devices and their applications in electronic circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
13 - 15	operation of a transformer coupling output stage operating in Class A, Class B push-pull configuration. 3.2 Explain why power is developed in the transistor and how to control it in operation 4.1 Develop complex (pre-amp/signal amp/power amp ) amplifier circuits and determine the biasing, Gains and power delivered in Loud speakers.	using equivalent circuit • Explain the principle of operation of the circuit. • Use head-phone speakers and develop circuits that the students can build in the practical.	
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

<b>Course: Electronics II</b>		<b>Course Code: EEC 234</b>	<b>Contact Hours: 30HRS PRACTICALS</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Build and test simple electronic circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 15	1.1 Determine by experiment the output and transfer characteristics of FET 1.2 Determine by experiment the d.c power dissipated by Class A, B, AB and C amplifier 1.3 Determine by experiment the power efficiency of Class A, B, AB, and C amplifiers 1.4 Perform experiment in investigate the high frequency response of an amplifier 1.5 Perform experiment to determine the low frequency	• Check the connection of the circuit made by students • Ensure that the students follow the instruction strictly	• Field affect transistors, bipolar transistors, voltmeter, ammeter, resistors, transistors cable, veroboard, oscilloscope, frequency counter/meter and stabilised power units

Course: Electronics II		Course Code: EEC 234	Contact Hours: 30HRS PRACTICALS
Course Specification: Practical tasks			
General Objective: Build and test simple electronic circuits			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1 - 15	response of an amplifier 1.6 Perform experiment to investigate the power output, power gain, efficiency and non linearity operation of power amplifier		
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

# Electronics III

EEC 244 ELECTRONICS III Y2/4<sup>th</sup> SEM 1/0/2 HRS/WK

**OUTCOME:**

On completion of this module the student should have an understanding of feedback effects in electronic circuits and where they can be of benefit.

<b>Course: Electronics III</b>		<b>Course Code: EEC 244</b>	<b>Contact Hours: 15 HRS Lecture</b>
<b>Course Specification: Theoretical contents</b>			
<b>General Objective: Understand the feedback effects in electronic circuits and their applications</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Notes</b>	<b>Resource</b>
1 - 3	1.1 Define Input and Output of a system, and understand it could mean many things in a given system. (e.g. voltage, or current in an amplifier) 1.2 Understand the general nature of positive and negative feedback in systems. 1.3 Show that the GAIN of a system is mainly determined by the feedback function and independent of forward gain. 1.4 Explain the general expression for stage gain of a basic feedback in amplifiers	<ul style="list-style-type: none"> <li>• Draw the block diagram of a basic feedback</li> <li>• Instructor must use Industrial examples wherever possible and bring visual components or demonstration to the lecture.</li> </ul>	
4 - 8	1.5 Understand the effect of applying negative feedback to an amplifier in relation to: <ul style="list-style-type: none"> <li>a. gain</li> <li>b. gain stability</li> <li>c. bandwidth</li> <li>d. distortion</li> <li>e. noise</li> <li>f. input and output resistance in a qualitative sense only.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop circuits based on an OPAMP and RC components and show how the function is obtained.</li> <li>• Give demonstrations in the class using an Oscilloscope of the waveforms and frequency meter.</li> <li>• Show how the frequency can be changed.</li> </ul>	

<b>Course: Electronics III</b>		<b>Course Code: EEC 244</b>	<b>Contact Hours: 15 HRS Lecture</b>
<b>Course Specification: Theoretical contents</b>			
<b>General Objective: Understand the feedback effects in electronic circuits and their applications</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teacher's Notes</b>	<b>Resource</b>
4 - 8	<p>2.1 Understand the properties of a PID controller.</p> <p>2.2 Appreciate where it can be used.</p> <p>2.3 Understand the circuit of a simple PID controller as a (P)roportional, (I)ntegral, and (D)erivative function generator.</p> <p>2.4 Appreciate it's widespread use in Industry.</p>		
9 - 15	<p>3.1 Explain how oscillators can be produced by an amplifier with positive feedback.</p> <p>3.2 Explain the operation of:</p> <ul style="list-style-type: none"> <li>- C oscillator</li> <li>L-C oscillator (Hartley &amp; Colpitts Oscillators)</li> </ul> <p>3.3 Describe methods of achieving frequency stability of oscillators e.g. piezo -electric crystal.</p> <p>4.1 Explain with the aid of suitable sketches the operation of the following multivibrators</p> <p>4.2 Explain simple applications of multivibrators circuits.</p> <p>4.3 Solve simple problems on multivibrators.</p>	<ul style="list-style-type: none"> <li>• Show the beneficial non linearity of the zener effect on the transistor multivibrators leading to voltage control frequency when the base is driven more than 5 volts negative. This applies to all transistors</li> </ul>	
<p><b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination</p>			



<b>Course: Electronics III</b>		<b>Course Code: EEC 244</b>	<b>Contact Hours: 30HRS Practicals</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Investigate through laboratory experiments effects of Feedback in electronic circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 15	<p>1. Experiment to investigate the effect (i.e. on a distorted signal, input and output impedances) of negative feedback on amplifiers.</p> <p>2. Experiment to investigate the conditions necessary for oscillation, and measure the frequency and amplitude of a sinusoidal signal of an LC Colpitts oscillator.</p> <p>3. Experiment to investigate the factors which affect the operation of LC Hartley oscillator and measure the frequency and amplitude of a generated signal.</p> <p>4. Experiment to investigate basic factors which influence the operation of transistorised astable multivibrator.</p> <p>5. Experiment to investigate the principle of operation of a transistorised bistable multivibrator.</p> <p>6. Experiment to investigate the operation of a transistorised monostable multivibrator.</p> <p>7. Experiment to observe and measure both the input and output waveforms of a bridge rectifier and the effects of different filter circuits</p>	<ul style="list-style-type: none"> <li>• These assignments will require a good quality Oscilloscope with working trigger facilities.</li> <li>• The instructor should ensure that the equipment is serviceable for this purpose.</li> <li>• The students must be made to follow a set procedure to trigger the scope having selected the trigger source.</li> <li>• These assignments are well presented in the book called "A manual of Laboratory Experiments in Electronics" by C.O. OROGE, FNSE</li> <li>• Assignments may be varied provided the outcomes are satisfied.</li> </ul>	<ul style="list-style-type: none"> <li>• Oscilloscope, oscillators,</li> <li>• op-amp, Multi-vibrator,</li> <li>• voltmeter, ammeter, cable</li> </ul>
<p><b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination</p>			

# Telecommunication Engineering I

EEC 128 TELECOMMUNICATION ENGINEERING I Y1.2<sup>ND</sup> SEMESTER 1/0/2 HRS/WK

## OUTCOMES:

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

1. Understand the basic principles of telecommunication system
2. Understand the principles of operation and application various transducers
3. Understand the basic principles of modulation and demodulation
4. Understand the principle of the radio receivers.

<b>PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY</b>			
<b>Course: TELECOMMUNICATION ENGINEERING I</b>		<b>Course Code: EEC 128</b>	<b>Contact Hours: 15 Hrs Lecture 30Hrs Practical</b>
<b>Course Specification: Theoretical Content and Practical (Industrial visit)</b>			
<b>General Objective: 1.0 Understand the basic principles of telecommunication system</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 2	1.1 Draw the block diagram of a simple communication system showing:- <ol style="list-style-type: none"> <li>a. Input transducer;</li> <li>b. Transmitter;</li> <li>c. Transmission channel;</li> <li>d. Receivers;</li> <li>e. Output transducer.</li> </ol> 1.2 Explain the function of the blocks listed in 1.1 above.	<ul style="list-style-type: none"> <li>• Draw a typical Tele-communication system and explain how it works.</li> <li>• Explain how a signal is generated from the transducer.</li> <li>• List various types of transducer that can be used for telecommunications.</li> <li>• Explain the need for modulation.</li> </ul>	<ul style="list-style-type: none"> <li>• Students to visit NITEL transmitter station &amp; Exchange, textbooks, chalk, board.</li> </ul>
<b>General Objective: 2.0 Understand the principles of operation and application of various transducers.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
3 - 5	2.1 Describe sound transducers; <ol style="list-style-type: none"> <li>a. Microphones</li> <li>b. loud speakers</li> </ol> 2.2 Explain, with the aid of diagrams, the principles of operation and uses of: <ol style="list-style-type: none"> <li>a. Carbon microphone;</li> <li>b. Crystal microphone;</li> <li>c. Moving coil loudspeaker;</li> </ol>	<ul style="list-style-type: none"> <li>• Explain the uses and operations of transducers</li> </ul>	<ul style="list-style-type: none"> <li>• Students to visit broadcasting stations, textbooks</li> </ul>

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: TELECOMMUNICATION ENGINEERING I		Course Code: EEC 128	Contact Hours: 15 Hrs Lecture 30Hrs Practical
Course Specification: Theoretical Content and Practical (Industrial visit)			
General Objective: 2.0 Understand the principles of operation and application of various transducers.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3 - 5	d. Moving iron telephone receiver e. Capacitor microphone		
General Objective: 3.0 Understand the basic principles of modulation and demodulation			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6 - 7	3.1 Explain the significance of modulation and demodulation in communication systems. 3.2 Explain the following modulation processes:- a. Amplitude modulation; b. Frequency modulation. 3.3 Explain the following regarding amplitude modulation: a. side frequencies; b. side band; c. modulation index; d. modulation envelope; e. bandwidth.	• Discuss the applications of modulation and demodulation to communication systems	
8 - 9	3.4 Solve problems involving the following: a. Modulation index; b. Bandwidth. 3.5 Explain the following terms regarding frequency modulation:- a. modulation index; b. deviation ratio; c. frequency deviation; d. system deviation; e. frequency swing. 3.6 Explain why F.M. has a wider bandwidth than A.M. 3.7 Compare the parameters of F.M. with		- do -

PROGRAMME: ND IN ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY			
Course: TELECOMMUNICATION ENGINEERING I		Course Code: EEC 128	Contact Hours: 15 Hrs Lecture 30Hrs Practical
Course Specification: Theoretical Content and Practical (Industrial visit)			
<b>General Objective: 3.0 Understand the basic principles of modulation and demodulation</b>			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8 - 9	A.M. 3.8 Solve problems involving 3.6 and 3.7 above.		
<b>General Objective: 4.0 Understand the principles of amplitude modulation and frequency modulation.</b>			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-11	4.1 Explain the working principles of amplitude demodulators 4.2 Explain the working principles of frequency demodulators.	• Solve problems.	
<b>General Objective: 5.0 Understand the principles of operation of the radio receiver</b>			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12 - 15	5.1 Draw the block diagram of the following radio receivers. a. straight; b. superheterodyne. 5.2 Explain the function of each block diagram in 5.1 5.3 Explain the choice of intermediate frequency in the superheterodyne receiver. 5.4 Explain the following phenomena in superheterodyne receiver:- a. adjacent channel interference b. image interference. 5.5 Explain the use of double superheterodyne to suppress image and adjacent channel interferences. 5.6 Explain the function of the automatic gain control (A.G.C.) 5.7 Explain with the aid of a block diagram, the working principle of an F.M. radio receiver.	• Draw Block diagram of radio receiver	• Dismantle a TV set and show the components to students.
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

# Telecommunication Engineering II

EEC 238 TELECOMMUNICATION ENGINEERING II Y2/3<sup>rd</sup> SEMESTER 1/0/2 HRS/WK

**OUTCOME:**

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

1. Know the principles of black and white television transmission
2. Know various frequency bands within the radio spectrum
3. Understand the principles of electromagnetic wave radiation
4. Understand the principles of radio wave propagation

<b>Course: TELECOMMUNICATION ENGINEERING II</b>		<b>Course Code: EEC 238</b>	<b>Contact Hours: 1/0/2hrs/wks</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective 1.0: Know the principles of black and white television transmission</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 3	Radio and Black/White T.V. Transmission 1.1 Draw block diagrams of the following radio transmitters using: a. amplitude modulation; b. frequency modulation. 1.2 Explain the function of each block in 4.1. 1.3 Draw the block diagram of a television transmitter (black & white). 1.4 Explain the function of each block in 4.3. 1.5 Explain how vision and sound signals are generated separately and transmitted together.	• Explain principle and circuit Diagrams of typical Telephone circuit.	• Textbooks, board, chalk, TV sets, frequency generator.
<b>General Objective 2.0: Know various frequency bands within the radio spectrum.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 7	Classification of Radio Frequencies 2.1 List the frequency ranges allocated to each of the following bands and their uses; a. (e.l.f.) extremely low frequency; b. (v.l.f.) very low frequency c. (l.f.) low frequency; d. (m.f.) medium frequency;	• Show the diagrams of different types of antenna and show how Signals are propagated.	-do-

<b>Course: TELECOMMUNICATION ENGINEERING II</b>		<b>Course Code: EEC 238</b>	<b>Contact Hours: 1/0/2hrs/wks</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective 2.0: Know various frequency bands within the radio spectrum.</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
4 - 7	<p>e. (h.f.) high frequency;</p> <p>f. (v.h.f.) very high frequency;</p> <p>g. (u.h.f.) ultra high frequency;</p> <p>h. (s.h.f.) super high frequency;</p> <p>i. (e.h.f.) extremely high frequency.</p>		
<b>General Objective 3.0: Understand the principles of electro-magnetic wave radiation</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
8 - 11	<p>3.1 Explain the function of an aerial as a radiator</p> <p>3.2 Know the current and voltage distribution of a dipole</p> <p>3.3 Explain aerial impedance and radiation resistance.</p> <p>3.4 Define an isotropic radiator</p> <p>3.5 Define the gain of an aerial</p> <p>3.6 Define the beamwidth of an aerial</p> <p>3.7 Sketch the polar diagram or the radiation pattern of an aerial.</p> <p>3.8 Sketch the horizontal and vertical plane patterns of a horizontal and vertical dipole.</p> <p>3.9 Identify various types of aerials: e.g. Yagi, Rhombic, etc.</p> <p>3.10 Sketch Yagi and rhombic aerials</p> <p>3.11 Explain the effect of frequency on aerial dimensions and performance.</p> <p>3.12 Explain the factors guiding the choice of aerials.</p>	<ul style="list-style-type: none"> <li>• Ask students to identify various, types and applications of aerial.</li> <li>• State the factors guiding the choice of aerials</li> </ul>	<ul style="list-style-type: none"> <li>• Aerials, textbooks, board, chalk, wave guides and coaxial cables</li> </ul>

<b>Course: TELECOMMUNICATION ENGINEERING II</b>		<b>Course Code: EEC 238</b>	<b>Contact Hours: 1/0/2hrs/wks</b>
<b>Course Specification Theoretical Content</b>			
<b>General Objective 4.0: Understand the principles of radio wave propagation</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
12 - 15	<p>4.1 Explain the following terms in relation to wave propagation;</p> <p>a. Ground waves;</p> <p>b. Sky waves;</p> <p>c. Space waves.</p> <p>4.2 Explain the existence and usefulness of the troposphere.</p> <p>4.3 Explain the effects of the troposphere on propagation below 30MHZ. Explain the various layers of the ionosphere such as:</p> <p>a. The D-layer;</p> <p>b. The E-layer;</p> <p>c. The F-layer.</p> <p>4.4 Explain critical and maximum usable frequency.</p> <p>4.5 Explain optimum working frequency.</p> <p>Solve problems involving wave propagation.</p>	<ul style="list-style-type: none"> <li>• Explain different types of wave propagation and their purpose</li> </ul>	- do -
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			

<b>Course: Telecommunications Engineering II</b>		<b>Course Code: EEC 280</b>	<b>Contact Hours: 30hrs Practicals</b>
<b>Course Specification: Practical tasks</b>			
<b>General Objective: Investigate and analyse the characteristics of simple telecommunication circuits</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 15	<p>1.1 Perform experiment on amplitude modulation with signals in audio frequency band</p> <p>1.2 Perform experiment on amplitude demodulation with AM modulated signal</p> <p>1.3 Perform experiment to determine the frequency deviation with FM modulated signal</p> <p>1.4 Carryout experiment on frequency demodulation with FM modulated signals</p> <p>1.5 Perform experiments on superheterodyne radio receiver</p> <p>1.6 Carryout experiment to determine impedance, radiation resistance, gain, beam-width and radiation power of aerials</p> <p>1.7 Carryout experiment to determine the video, composite waveform and sync.pules of TV receiver circuits</p>	<ul style="list-style-type: none"> <li>• Teachers should involve the students in the experiments</li> <li>• Ask the students to submit their reports for assessment</li> </ul>	<ul style="list-style-type: none"> <li>• AM and FM emonstration units, oscilloscope, frequency generator, RF and AF demonstration units, superheterodyne receiver</li> </ul>
<b>Assessment:</b> The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% the total score, while the remaining 50% will be for the end of Semester examination			



# PROJECT

## Project

EEC 280 PROJECT AND PROJECT REPORT WRITING Y2/4<sup>TH</sup> SEMESTER 0/0/3 HRS/WK

### OUTCOMES

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

1. Understand the practical constructional requirements of the project undertaken
2. Understand the standard format for project report writing

<b>Course: PROJECT AND PROJECT REPORT WRITING</b>		<b>Course Code: EEC 280</b>	<b>Contact Hours: 45hrs/wks</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 1.0: Understand the practical constructional requirements of the project undertaken</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
1 - 4	1.1 Identify all the components in a given circuit 1.2 Explain the functionality of a schematic/block diagram given for the project. 1.3 Plan the layout for the execution of the project on stage-by-stage basis. 1.4 Carry out the execution of the project as scheduled in (1.3) 1.5 Test the functionality of the completed project. 1.6 Carry out correction of any detected error/faults	Teacher should give every necessary assistance to students during supervision	Chalk, board, circuit diagrams, layout and textbooks
<b>General Objective 2.0: Understand the standard format for project report writing</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 8	2.1 Explain the purpose of each of the following sections of a project report. <ol style="list-style-type: none"> <li>a. Cover page</li> <li>b. Title page</li> <li>c. Approval page</li> <li>d. Declaration page</li> <li>e. Table of contents</li> <li>f. Acknowledgements</li> <li>g. Abstract/Summary</li> <li>h. List of symbols/abbreviations</li> <li>i. List of tables</li> </ol>	<ul style="list-style-type: none"> <li>• Explain to the students the approved format of writing technical reports</li> <li>• Show samples of project reports in the standard format</li> </ul>	- do -

<b>Course: PROJECT AND PROJECT REPORT WRITING</b>		<b>Course Code: EEC 280</b>	<b>Contact Hours: 45hrs/wks</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Understand the standard format for project report writing</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
5 - 8	<ul style="list-style-type: none"> <li>j. List of figures</li> <li>k. Body of the project report, divided into chapters</li> <li>l. References</li> <li>m. Appendices</li> </ul> <p>2.2 Explain the standard format of writing items (i) - (x) in 2.1 above. Arrange the body of the project report, according to the following chapters:</p> <p>2.3 Explain the standard format of writing references in regards to the following:</p> <ul style="list-style-type: none"> <li>a. Textbooks</li> <li>b. journals</li> <li>c. past students' projects</li> <li>d. lecturer notes</li> <li>e. newspapers/magazine</li> <li>f. seminars/workshops, etc</li> </ul> <p>2.4 Explain the standard format of presenting appendices in the form of</p> <ul style="list-style-type: none"> <li>a. tables</li> <li>b. diagrams</li> <li>c. parts list, graphs, etc</li> </ul>		
9 - 15	<p>Chapter 1 Introduction: Purpose and scope of the project, principle of operation, limitation</p> <p>Chapter 2 Literature Review: Review of theory relating to the project topic, review previous studies, methods or works done by other authors or previous students' projects.</p> <p>Chapter 3 Construction: State-by-stage procedure for the construction, (including well-labelled working diagrams and pictures (if need be)).</p> <p>Chapter 4 Testing, Results and Discussion: Test procedures</p>	<ul style="list-style-type: none"> <li>• Guide the students to present their project reports in format of technical report</li> </ul>	- do -

<b>Course: PROJECT AND PROJECT REPORT WRITING</b>		<b>Course Code: EEC 280</b>	<b>Contact Hours: 45hrs/wks</b>
<b>Course Specification: Theoretical Content</b>			
<b>General Objective 2.0: Understand the standard format for project report writing</b>			
<b>Week</b>	<b>Specific Learning Outcome:</b>	<b>Teachers Activities</b>	<b>Resources</b>
9 - 15	(including safety precautions),Presentation of results (including where necessary, tables graphs, calculators etc) Chapter 5 Conclusion & Recommendation: Compare results with theory, stating reasons for difference(s), recommendations for further work, if need be.		
<b>Assessment:</b> The project, report writing and project defence will be awarded 100% of the total score.			

# LIST OF MINIMUM RESOURCES

## BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)

S/NO	ITEMS DESCRIPTION	QUANTITY
1	Basic Electricity Kit	10
2	Ammeters (Various ranges)	5
	0- 25 A DC	10
	0- 25 A AC	10
3	Milliammeter	
	0- 1000mA DC	10
	0- 1000mA AC	10
4	Micrommeter	
	0- 1000mA DC	10
	0- 1000mA AC	10
5	Voltmeter	
	0- 500V DC	10
	0- 500V AC	10
6	Millivoltmeter	
	0- 1000mV DC	10
7	Variac	5
8	Ohmeter	
	0- 5 ohms	10
	0- 25 ohms	10
	0- 50 ohms (Multirange)	10
9	Galvanometer (triple range)	
	50-0-50mA	10
	500-0-500mA	10
	5-0-5 mA	10
10	Wattmeter	
	Single phase	5
	Three phase	5
11	Megger tester	
12	Wheastone Bridge	
13	Potentiometer	5
14	Electronic Traniner Units	5

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

S/NO	ITEMS DESCRIPTION	QUANTITY
15	C R Oscillators	5
16	Experimental Trainer for AC and DC	2
17	Rheostals (Various ranges)	20
18	Earth-loop tester	5

**MACHINE LABORATORY (ND)**

1.	Motor Generator sets for laboratory use (DC supply source)	2 units
2.	Techogenerator	5 units
3.	DC motors:	
- Series		3
- Shunt		3
- Compound		3
4.	DC Generators	3
- Self excited		1-
		Separately
excited		2
- Shunt		2
- Compound		3
- Starters		
5.	A. C. Motors:	
- single phase induction motors (assorted)		5
	- 3 phase induction motor	3
- Dynamometer set		2
	- Direct on line starters	4
- Star-delta starters		4
- Auto Transformer Starter		1
6.	Transformers:	
- Demonstration unit		1
- Single phase		4
- 3 phase		4
- Transformer demonstrator/trainer unit		4

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

<b>S/NO</b>	<b>ITEMS DESCRIPTION</b>	<b>QUANTITY</b>
7.	Variable resistance load	5
8.	Variable inductive load	5
9.	Variable capacitive load	2
10.	Machine control panel trainer	

**ELECTRICAL POWER LABORATORY (ND)**

1.	Demonstration units	2
2.	Stabilizer power units	
3.	Transformer (power)	1
4.	Power factor meter	5
5.	Wattmeter:	
- Single		5
- 3 Phase		5
6.	Energy meter:	
- Single		5
- 3 Phase		5
7.	Voltmeter:	
- 0 - 500 DC		5
- 0 - 500 AC		5
8.	Ammeter:	
- 0 - 15A		10
- 0 - 5A		10
- 0 - 30A		5
9.	Clip-on ammeter	4
10.	Digital phase meter	2
11.	Distribution and Transmission lines units	5 each
12.	Megger testers	2
13.	Multimeter (AVO)	5
14.	Universal multimeter (digital)	3
15.	Tachometer (mechanical)	3
16.	Stroboscope	2
17.	Phase sequence meter	2

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

S/NO	ITEMS DESCRIPTION	QUANTITY
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**ELECTRICAL MAINTENANCE AND REPAIR WORKSHOP (ND) & (HND)**

1.	Bench vices	10
2.	Pedestral drill	2
3.	Electrical hand drill	3
4.	Electric cookers, fans, iron etc. (used ones)	7
5.	Motors (assorted) used ones	3
6.	Generators (assorted) used	1
7.	Starter:	
	- Direct online	3
	- Star delta	3
	- Auto Transformer	1
8.	Coil winding equipment (Rewinding)	2
9.	Refrigerator (used)	2
10.	Transformers (Power) used	1
11.	Megger	2
12.	Battery charging facilities	
	Charger ( trickle, constant current and constant voltage charging system)	
	- Battery	
	- Electrolytes	
	- Hydrometer	
	- Voltmeter (Volt-tester)	
13.	- AVO meter or multi-megger	2
14.	Earth-loop tester	1

Electrical Maintenance and Repair Workshop is subdivided into:

\* Electrical Coil winding section

\* Domestic appliances section

\* Battery - charging section.

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

<b>S/NO</b>	<b>ITEMS DESCRIPTION</b>	<b>QUANTITY</b>
<b>ELECTRICAL INSTALLATION WORKSHOP (ND)</b>		
1.	Wiring boards (1m x 2m)	30
2.	Pedestal drill	1
3.	Hand drill	5
4.	Electrician tool kits	30 sets
5.	Cable recessing tools	5
6.	Conduit bending machine, and accessories	5 sets
7.	Bench vices	5
8.	Equipment for underground cable installations	2 sets
9.	Tools for installation of metal conductors (e.g. MICC cables)	2 sets
10.	Earth leakage circuit breakers (ELCE)	5
11.	Cable jointing kits for:	
- Soldering pot & ladle		2
	- Soldering iron	30
- Modern Raychem joints		3
- Blowlamp		3 sets
12.	Earth rods and accessories	5 sets
13.	Simulated wall for vertical conduit and metal cable installations	
14.	Various sizes of PVC cables	
15.	MICC cables and accessories	
16.	Underground cables and accessories	
17.	Trunking installation equipment	
18.	Trunkings	
19.	Tray installation equipment	
20.	Various consumables	
21.	Meggers	



**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

S/NO	ITEMS DESCRIPTION	QUANTITY
22.	Overhead line materials:	
	- Safety belts	10
	- Conductor joint kits	10
	- Testing equipment for power line	2
	- Earthing kits	3

Electrical Installation Workshop is subdivided into:

\* Surface, Conduit, Trunking and Ducting wiring installation section

\* Lighting and heating systems installation section

\* Power Cable jointing and special installation section (Underground and Overhead cable installation section).

\* Electrical machines installation section.

**ELECTRONIC WORKSHOP (ND)**

1.	AVO meter	5
2.	Megger tester	5
3.	Valve tester	5
4.	Transistor tester	5
5.	Galvanometer	5
6.	Soldering programme complete with tool kit, bench-stand, and desoldering tool	5
7.	Soldering iron (assorted)	30
8.	Radio set ive - 3; dead	5
9.	TV (Black & White) sets (live - 2, dead)	5
10.	TV set colour (HND only)	2
11.	Amplifiers	5
12.	Microphones	5
13.	Transceivers	2
14.	Receivers	5
15.	Player decks	5
16.	Electronic technician tool kits	30

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

S/NO	ITEMS DESCRIPTION	QUANTITY
17.	Video set (HND only)	

Electronic Workshop is subdivided into:

- \* Radio receiver & audio systems servicing section
- \* Television receiver & Video player servicing section
- \* Mobile and fixed Telephone sets servicing section.

**ELECTRONIC/COMMUNICATION LABORATORY (ND)**

1.	Semi conductor kit	5
2.	Electrical and thermionic fundamentals laboratory kits	5
3.	Communication receivers demonstration units (radio, including transistor receiver)	5
4.	Experimental trainer for electronic circuits	5
5.	Transistor amplifier demonstrator	10
6.	Oscilloscopes:	
	- Single trace 5MHz Probe	
	- Dual trace 15 MHz	5
	- Storage screen display Oscilloscope	1
7.	Signal generators (AF, RF)	5 each
8.	Valve tester	
9.	Transistor tester	5
10.	Power supply unit 0-60v/3A	10 units
11.	Amplifiers	5
12.	Sweep generator	5
13.	Multirange DC voltmeters	10
14.	Multirange AC voltmeter	20
15.	Multirange AC ammeter	20
16.	Multirange DC ammeter	20
17.	Circuit construction deck	20
18.	DC power supply out-put 0 - 20V/0-2A	10

**BASIC ELECTRICAL/MEASUREMENT AND INSTRUMENTATION LAB. (ND)**

<b>S/NO</b>	<b>ITEMS DESCRIPTION</b>	<b>QUANTITY</b>
19.	Milliammeter:	
-0- 1000m A DC		5
-0- 1000m A AC		5
20.	Microammeter:	
-0- 1000mA DC		10
-0- 1000m A AC		10
21.	Millivoltmeter	
-0- 1000m V DC		10
22.	Galvanometer (triple pole range)	
-50-0-50m A		10
-500-0500m A		10
-5-0-5m A		10
23.	RLC bridge	10
24	Avometer (Model-8)	5

# LIST OF BOOKS (ND)

## 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, Antenna, 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 - Fitzgerald 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<sup>th</sup> 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

### **NATIONAL DIPLOMA AND HIGHER NATIONAL DIPLOMA**

# 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 minds 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.

- One book should be produced for each syllabus
- Page size should be A4
- The front size should be 12 point for normal text and 14 point where emphasis is need
- Line spacing should be set to 1.5 lines
- Headings and subheadings should be emboldened
- Photographs, diagrams and charts should used extensively thought the book, and these items must be up-to-date
- In all cases the material must be related to industry and commerce, using real life examples wherever possible so that the book is just a theory book. It must help the students to see the subject in the content of the 'real word"
- 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 and artificial divided between theory and practice.
- Illustrations should labeled and numbered.
- Examples should drawn from Nigeria wherever possible, so that the information is set in a country context.
- Each chapter should end with student self-assessment quotations (SAG) so that student can check their own master of the subject.
- Accurate instructions should be given for any practical work having first conducted the practical to check that the instructions do indeed work
- 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.
- Symbols and units must be listed and a unified approach used throughout the book
- 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.
- 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.

# LIST OF PARTICIPANTS

## UNESCO-NIGERIA PROJECT IN SUPPORT OF REVITALISATION OF TECHNICAL AND VOCATIONAL EDUCATION IN NIGERIA

### PROJECT TEAM MEMBERS

S/No.	NAME	DESIGNATION
1	Engr. Dr. Nuru A. Yakubu	National Project Coordinator & Executive Secretary, NBTE
2	Dr. M.S. Abubakar	Technical Coordinator
3	Engr. S.C. Odumah	Curriculum Development Coordinator
4	Mr. B.N. Niriyyus	Staff Development Coordinator
5	Engr. Dr. S.N. Mumah	Information & Communication Technology Coordinator
6	Isa Alhaji Sulaimanu	Project Accountant
7	Mal. A.D.K. Muhammad	Project Officer

### Curriculum Review Team Members for Information and Communication Technology (ND/HND Programmes)

S/No.	NAME	ADDRESS
1	Engr. Dr. S.N. Mumah	Kaduna Polytechnic, Kaduna (ICT Coordinator)
1	Dr. (Mrs) A.O. Osofisan	University of Ibadan( Team Leader)
2	Dr. (Mrs) Iyabo Fagbulu	UNESCO, Abuja
3	Mrs A. Olarewaju	HTCC, Kaduna Polytechnic, Kaduna
4	Mr. A. Adekigbe	Federal Polytechnic, Ede
5	Dr. O.E. Osuagwa	Federal University of Technology, Owerri
6	Dr. E.R. Adagunodo	O.A.U. Ile-Ife
2 <sup>nd</sup> PHASE REVIEW		
1	Mrs A. Olarewaju	HTCC, Kaduna Polytechnic, Kaduna
2	Engr. E.C. Onyeiwu	ECO Project Services, Kaduna

**CURRICULUM DEVELOPMENT TEAM MEMBERS FOR ND/HND ELECTRICAL ENGINEERING TECHNOLOGY**

<b>S/No</b>	<b>NAMES</b>	<b>ADDRESS</b>
1	Prof. R.I. Salawu	INILAG, Lagos(Team Leader)
2	Engr. Dr. D.I. Isah	Kaduna Polytechnic, Kaduna
3	Engr. O.T. Alagba	National Institute of Instrument Engineers, Lagos
4	Mrs Anne Omobhude	National Institute of Instrument Engineers, Lagos
5	Prof.C.O.A.Awosope	UNILAG, Lagos
6	Chief L.O. Onyenwe	NITEL, CAPPA, Oshodi, Lagos
7	Dr. J. Katende	Bayero University, Kano
8	Engr. J.A. Adeoti	Yaba College of Technology, Lagos
9	Engr. C.O. Oroge	Kaduna Polytechnic, Kaduna
10	Engr. O.I. Nwankwo	Federal Polytechnic, Nekede
11	Engr. Dr. G.A. Mustapha	NDA, Kaduna
12	Engr. C. Aduayi	Federal Polytechnic, Ado-Ekiti
13	A.Odunlade	Yaba College of Technology, Yaba
14	O.B. Jemilehim	NEPA, PSTC, Ijora, Lagos
15	Mr. Emesue	ITF, Jos