# NATIONAL BOARD FOR TECHNICAL EDUCATION
# CURRICULUM AND COURSE SPECIFICATIONS

## NATIONAL DIPLOMA

## IN

## COMPUTER ENGINEERING TECHNOLOGY

For general availability of supporting materials referred to in this book and for further information on the Editors or Contributors, please write to:

National Board for Technical Education
Plot B, Bida Road,
P. M. B. 2239,
Kaduna.

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## 1.0 GENERAL INFORMATION

### 1.0 CERTIFICATION AND TITLE OF THE PROGRAMME:

The certificate to be awarded and the programme title shall read: "NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY"

## 2.0 GOAL AND OBJECTIVES

The National Diploma Programme in Computer Engineering Technology is designed to produce computer technician to install, maintain and repair computer system software, hardware and its peripherals. More specifically, diplomats of the programme should be able to:

a) Draw the layout for computers installation and networking;
b) Set up computer systems for installation, configuration and operation;
c) Set up computer networks for installation configuration and operation;
d) Use appropriate instruments and software to carry out simple tests and measurements on all subsystems in a computer and its peripherals;
e) Carry out routine maintenance and repair of:
    i. Computer Hardware;
    ii. Computer Software; and
    iii. Computer Peripherals.
f) Construct simple computer circuit;
g) Develop simple programming codes;

h) Write technical reports; and
i) Manage a small enterprise.

(DISCUSS THE VERBS WITH DANMOWA)

j) Draw and map out the layout for computers installation and networking;
k) Set up, install, configure and operate computer system;
l) Set up, install, configure and operate computer networks;
m) Select and use appropriate instruments and software to carry out simple tests and measurements on all subsystems in a computer and its peripherals;
n) Carry out routine maintenance and repair of:
   iv. Computer Hardware;
   v. Computer Software; and
   vi. Computer Peripherals.
o) Construct and test simple computer circuit;
p) Develop simple programming codes;
q) Write and present technical reports; and
r) Set up and manage a small enterprise.

## 3.0 ENTRY REQUIREMENTS

Entry requirements for the National Diploma in Computer Engineering Technology programme include at least a minimum score in the Unified Tertiary Matriculation Examination (UTME), five credit passes at not more than two sittings in West African Senior School Certificate of Education (WASSCE), Senior School Certificate of Education (SSCE), National Technical Certificate (NTC), General Certificate of Education (GCE) Ordinary level, or the West African Examination Certificate (WAEC) in relevant subjects. The relevant subjects are: English Language, Mathematics, Physics, Chemistry and one other subject from: Metal Work, Wood Work, Technical Drawing, Basic Electronics, Basic Electricity, Economics, Commerce, Statistics, Further Mathematics, Computer Studies, Geography and Biology or Agricultural Science. (Details of Admission requirements are obtainable in the NBTE annual Directory of Accredited Programmes).

4.0 CURRICULUM

4.1 The curriculum of all ND programmes consists of the following four main components:

i. General Studies/Education
ii. Foundation courses
iii. Professional courses
iv. Supervised Industrial Work Experience Scheme (SIWES)

4.2 The General Education Components shall include courses in:

- Art and Humanities – English Language, Communication, History
- Social Studies – Citizenship Education, Political Science, Sociology, Philosophy, Geography and Entrepreneurship Studies

The General Education component shall account for not more than 10 - 15% of total contact hours for the programme.

4.3 Foundation Courses include courses in Mathematics, Pure Science, Technical Drawing, Descriptive Geometry, etc. The number of hours will be 10 -15% of the total contact hours.

4.4 Professional Courses are courses that give the student theory and practical skills he needed to practice at the Technician level. These may account for 60-70% of the contact hours.

4.5 Student Industrial Work Experience Scheme (SIWES) shall be taken during the long vacation following the end of the second semester of the first year. See details of SIWES at paragraph 9.0.

5.0 Curriculum Structure:

The structure of the ND Programme consists of four semesters of classroom, laboratory and workshop activities in the Institution and a semester (3-4 months) of student industrial work experience scheme (SIWES). Each semester shall be seventeen (17) weeks of duration made up of:

- 15 contact weeks of teaching, i.e. recitation, practical exercises, quizzes, test, etc; and
- 2 weeks for examinations and registration.

SIWES shall take place at the end of the second semester of the first year.

6.0 PROJECT

Project shall be submitted at the end of the second semester of the final year.

**7.0** ACCREDITATION

Each programme offered either at the ND or HND level shall be accredited by the NBTE before the diplomates can be awarded either of the two diploma certificates. Details about the process of accrediting a programme for the award of ND or HND are

available from the Executive Secretary, National Board for Technical Education, Plot B Bida Road, P.M.B. 2239, Kaduna, Nigeria.

**7.1** Conditions for the Award of ND:
Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed course-work, examinations, diploma project and the supervised industrial work experience. Such candidates should have completed a minimum of 90 and 100 semester credit units. National Diploma Certificate shall be awarded based on the following:-

i. Grading of Courses: Courses shall be graded as follows:

| MARKED | LETTER GRADE | WEIGHTING |
|---|---|---|
| 75% and above | A | 4.00 |
| 70% – 74% | AB | 3.50 |
| 65% – 69% | B | 3.25 |
| 60% – 64% | BC | 3.00 |
| 55% – 59% | C | 2.75 |
| 50% – 54% | CD | 2.50 |
| 45% – 49% | D | 2.25 |
| 40% – 44% | E | 2.00 |
| Below 40% | F | 0.0 |

ii. Classification of Diplomas: Diploma Certificates shall be awarded based on the following classifications:

| | | |
|---|---|---|
| Distinction | - | CGPA 3.50-4.00 |
| Upper Credit | - | CGPA 3.00-3.49 |
| Lower Credit | - | CGPA 2.50-3.00 |
| Pass | - | CGPA 2.00-2.49 |

**8.0** Guidance Notes for Teachers of the Programme:

**8.1** 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 standard from which he is transferring.

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

**8.3** As the success of the credit unit system depends on the articulation of programmes between the institution and industry, the Curriculum content has been written in behavioral objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance is 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 follow that with the criteria for determining an acceptable level of performance. The Academic Board of the institution may vet departmental submission on the final curriculum. Our aim is to continue to see to it that a solid internal Evaluation system exist in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

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

**8.5** To be considered a specialist teaching this programme, the instructor / lecturer must possess qualifications in COMPUTER ENGINEERING or related disciplines, e,g. Electronics, Telecommunication, Control, etc.

**8.6** SYNOPSIS OF THE ACADEMIC & CAREER PROGRESSION OF ND HOLDER
He/ She

1. Can be admitted into HND programmes e.g Computer Engineering, Electronics and Telecommunication
2. Can be admitted through Direct Entry (DE) into bachelor"s degree programmes
3. Can work as a technician
4. Can manage a computer business Centre and any other related enterprise

9.0 GUIDELINES ON SIWES PROGRAMME:

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

9.1 Responsibility for placement of students

a) Institutions offering the ND programme shall arrange to place the students in industry by April 30 of each year, six copies of the 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

b) 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 student during the period. It should be noted that the final grading of the student during the period of the attachment should be weighted more on the evaluation by his industry-based supervisor

9.2 Evaluation of students during the SIWES

In the evaluation of the student, cognizance 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

9.3 Grading of SIWES

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

9.4 The Institution Based Supervisor

The Institution-based supervisor should initiate the logbook during each visit. This will enable him to check and determine to what extent the objective 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.

9.5 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; and
2) A final visit in the last month of the attachment

9.6 Stipends 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

9.7 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 on a fail or pass basis. Where a student has satisfied all other requirements but failed SIWES, he may only be allowed to repeat another four months SIWES at his own expense.

COMPUTER ENGINEERING TECHNOLOGY
NATIONAL DIPLOMA (ND) CURRICULUM TABLE

ND 1 SEMESTER 1

| S/N | CODE | COURSE TITLE | L | P | T | CU | CH |
|---|---|---|---|---|---|---|---|
| 1. | GNS 101 | Use of English I | 2 | - | - | 2 | 2 |
| 2. | GNS 102 | Citizenship Education I | 2 | - | - | 2 | 2 |
| 3. | MTH 112 | Algebra and Elementary Trigonometry | 2 | - | - | 2 | 2 |
| 4. | STA III | Introduction to Statistics | 2 | - | - | 2 | 2 |
| 5. | MEC 101 | Technical Drawing | 1 | 2 | - | 2 | 3 |
| 6. | MEC 107 | Mechanical Engineering Science | 2 | 2 | - | 3 | 4 |
| 7. | MEC 113 | Basic Workshop Technology and Practice | 1 | 2 | - | 3 | 3 |
| 8. | EEC 115 | Electrical Engineering Science 1 | 1 | 1 | - | 2 | 2 |
| 9. | EEC 116 | Electrical Workshop Practice 1 | 1 | 2 | - | 2 | 3 |
| 10. | COM 111 | Introduction to Computer | 2 | - | - | 2 | 2 |
| TOTAL | | | 16 | 9 | - | 22 | 25 |

ND 1 SEMESTER 2

| S/N | CODE | COURSE TITLE | L | P | T | CU | CH |
|---|---|---|---|---|---|---|---|
| 1. | GNS 102 | Communication In English | 2 | - | - | 2 | 2 |
| 2. | GNS 128 | Citizenship Education II | 2 | - | - | 2 | 2 |
| 3. | MTH 211 | Calculus | 2 | - | - | 2 | 2 |
| 4. | MEC 102 | Descriptive Geometry | 2 | | - | 2 | 2 |
| 5. | MEC 108 | Introduction to Thermodynamics | 2 | - | - | 2 | 2 |
| 6. | EEC 124 | Electronics 1 | 2 | 2 | - | 3 | 4 |
| 7. | EEC 126 | Electrical Workshop Practice II | - | 2 | - | 1 | 2 |
| 8. | COM 122 | Computer Operations | 2 | - | - | 2 | 2 |
| 9. | COM 221 | Computer Programming (FORTRAN) | 2 | 2 | - | 3 | 4 |
| 10. | CTE 121 | Digital Computer Fundamentals 1 | 2 | - | - | 2 | 2 |
| 11. | CTE 122 | Electrical Measurement and Instrumentation 1 | 1 | 2 | - | 2 | 3 |
| TOTAL | | | 19 | 8 | - | 23 | 27 |

ND 2 SEMESTER 3

| S/N | CODE | COURSE TITLE | L | P | T | CU | CH |
|---|---|---|---|---|---|---|---|
| 1. | GNS 201 | Use of English II | 2 | - | - | 2 | 2 |
| 2. | MTH 202 | Logic and Linear Algebra | 2 | - | - | 2 | 2 |
| 3. | EEC 239 | Electrical Circuit Theory 1 | 2 | - | - | 2 | 2 |
| 4. | EEC 234 | Electronics II | 2 | 2 | - | 3 | 4 |
| 5. | CTE 231 | Micro Computer Fundamentals | 2 | 2 | - | 3 | 4 |
| 6. | CTE 232 | Computer Workshop Practice I | - | 2 | - | 2 | 2 |
| 7. | CTE 233 | Digital Computer Fundamentals II | 2 | 2 | - | 3 | 4 |
| 8. | CTE 234 | Computer Architecture | 1 | - | - | 1 | 1 |
| 9. | CTE 235 | Electrical Measurement and Instrumentation II | 1 | 2 | - | 2 | 3 |
| 10. | CTE 236 | Electronic/Computer Maintenance and Repair * | 1 | 2 | - | 2 | 3 |
| TOTAL | | | 15 | 12 | - | 22 | 27 |

ND 2 SEMESTER 4

| S/N | CODE | COURSE TITLE | L | P | T | CU | CH |
|---|---|---|---|---|---|---|---|
| 1. | GNS 202 | Communication In English II | 2 | - | - | 2 | 2 |
| 2. | MTH 122 | Trigonometry and Analytical Geometry | 2 | - | - | 2 | 2 |
| 3. | EEC 249 | Electrical Circuit Theory II | 2 | - | - | 2 | 2 |
| 4. | CTE 245 | Telecommunication Engineering | 2 | 2 | - | 3 | 4 |
| 5. | CTE 241 | Introduction to Micro-processor and Micro-programming | 1 | 2 | - | 2 | 3 |
| 6. | CTE 242 | Computer Workshop practice II | - | 2 | - | 1 | 2 |
| 7. | CTE 243 | Operating Systems | 2 | - | - | 2 | 2 |
| 8. | CTE 244 | Computer Power Systems*/ Introduction to Control | 2 | - | - | 2 | 2 |
| 9. | CTE 246 | Project | - | - | | 6 | 6 |
| TOTAL | | | 13 | 6 | | 22 | 19 |

| | | |
|---|---|---|
| L | = | LECTURE HOURS |
| P | = | LABORATORY/PRACTICAL HOURS |
| T | = | TUTORIAL HOURS |
| CU | = | COURSE UNIT |
| CH | = | CONTACT HOURS |

| | | |
|---|---|---|
| Programme: National Diploma in Computer Engineering | Course Code: EEC 115 | Contact Hour: 45 |
| Course: Electrical Engineering Science I | Semester 1 | Theoretical: 1 hr/week |
| Year I | Pre-requisite: | Practical: 2 HR/Week |
| Goal: this course is intended to provide the student with basic knowledge of Electrical Engineering Science | | |
| General Objectives: On completion of this course the student should be able to:<br><br>1. Understand the concept of electric current flow.<br>2. Understand simple d.c. Circuits.<br>3. Understand various types of energy and their inter-relationship.<br>4. Understand the concept of electrostatics, electric charge and capacitance of capacitors. | | |

| | Theoretical Content | | | Practical Content | | |
|---|---|---|---|---|---|---|
| General Objectives 1 Understand the concept of electric current flow | | | | | | |
| Week | Specific Learning Outcomes | Teacher's Activities | Learning Resources | Specific Learning Outcomes | Teacher's Activities | Evaluation |
| 1-3 | 1.1 Define an atom.<br>1.2 Explain the structure and composition of an atom.<br>1.3 Differentiate between conductors, insulators and semi-conductors.<br>1.4 Explain the concepts of current and electron flow.<br>1.5 Define electric current, potential difference, electromotive force (e.m.f) and resistance, their units and symbols.<br>1.6 State multiples and sub-multiples of Electric quantities; (e.g. Mega (M) - $10^6$, kilo (K) - $10^3$, etc). | • Draw atomic structure to explain its composition to the students<br>• Explain the electron mobility<br>• Draw the atomic structure to explain the unique differences in their structure.<br>• Explain with the aid of diagrams how the current & electron flow.<br>• Write down the formulae and symbols for current flow, p.d. or e.m.f., resistance.<br>• Explain them to the students.<br>• Explain quantities of electricity and their | White Board, textbooks, lecture notes, Internet sites, PC loaded with Presentation software package and connected to multimedia Projector, calculator | | | Explain the concepts of current and electron flow and electric current,<br><br>List potential difference between electromotive force (e.m.f) and resistance.<br><br>Write out their units and symbols |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | units | | | | |
| General Objectives 2 Understand simple D,C, circuits | | | | | | |
| 4-9 | 2.1 Define d.c. current.<br>2.2 State the analogy between current-flow, and water flow.<br>2.3 Describe basic d.c. circuits.<br>2.4 Explain ohm"s law.<br>2.5 Solve problem using ohm"s law.<br>2.6 Define resistivity and conductivity of a conductor.<br>2.7 State the relationship between resistance of a conductor, its resistivity, length and area.<br>2.8 Differentiate between series and parallel circuits.<br>2.9 Solve problems involving resistivity and conductivity<br>2.10 Deduce the equivalent resistance of series and parallel circuits.<br>2.11 Explain Kirchhoff"s laws.<br>2.12 Explain the super position principles.<br>2.13 Solve problems involving series and parallel circuits using kirchff"s laws and superposition | • State the definition of current. Explain how flow of current is similar to the flow of water.<br>• Draw the basic d.c circuit with source.<br>• Explain the flow of current.<br>• Use diagrams to explain Ohms law.<br>• Give examples of some circuits with resistive components.<br>• Explain how to obtain resistivity and conductivity from the formula R = ρ1/a<br>• Explain how to obtain resistivity from the formula R =ρ1/a<br>• Draw the circuit diagrams for series and parallel connections. | White Board, textbooks, lecture notes, Internet sites, PC loaded with Presentation software package and connected to multimedia Projector, calculator | 2.1 Perform experiment on a single loop d.c circuit with variable e.m.f<br>2.2 Verify Ohm's law<br>2.3 Verify by experiment the resistivity of a material.<br>2.4 Carry out experiments on series and parallel circuits.<br>2.5 Verify Kirchhoff"s law with d.c circuits.<br>2.6 Verify superposition principles.<br>2.7 Determine by experiment the temperature coefficient of resistance.<br>2.8 Verify by experiment the heating effect of electric current | • Explain the procedures to be followed to the students<br>• Identify the set of equipment to be used for each experiment<br>• Relate the theory to with the experiments to be performed<br>• Assign students into groups<br>• Provide practical manuals and reporting guidelines to the students<br>• Ensure students activities are recorded in standard laboratory notebook<br>• Assess the students practical works and add | Explain the following:<br><br>-Basic Electricity Trainers, Electronic Trainers, Oscilloscopes, Digital/Analogue Multimeters, Ammeters, Voltmeters, Potentiometers, Wheatstone bridges, Rheostats, Variacs, Wattmeters |

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|---|---|---|---|---|---|---|
| | principles.<br>2.14 Define temperature coefficient of resistance.<br>2.15 Use the expression for resistance at temperature $T^0k$ and to $O^0k$ to calculate changes in resistance.<br>2.16 Draw the graph of resistance against temperature.<br>2.17Deduce from 2.15 the change in resistance due to change in temperature.<br>2.18 Solve problems involving effect of temperature on resistance. | • Explain the differences between the Kirchhoff's laws and superposition principles. Give examples.<br>• Explain the relationship between the temperature and resistance of a wire.<br>• Show how to calculate a change in resistance when the temp changes.<br>• Explain why there is a temperature change when the current flows through a wire.<br>• Show a typical graph of resistance against temperature | | | appropriate comments | |
| General Objectives 3 Understand various types of energy and their inter-relationship | | | | | | |
| 10-11 | 3.1 Explain various types of energy.<br>3.2 Explain the relationship between electrical, mechanical and thermal | • Explain the sources of various energy generations.<br>• Show how they | White Board, textbooks, lecture notes, Internet sites, PC loaded | 3.1 Determine by experiment power in a d.c. circuit.<br>3.2 Verify | • Explain the procedures to be followed to the students<br>• Identify the set | Differentiates between the following:<br><br>Basic Electricity Trainers, Oscilloscopes, |

| | | | | | | |
|---|---|---|---|---|---|---|
| | energy.<br>3.3 State S.I. units of various types of energy in 3.2.<br>3.4 State Joule‟ law.<br>3.5 Solve problems involving Joule‟s law. | are related to electrical energy<br>• Revise the importance and types and of energy with the students | with Presentation software package and connected to multimedia Projector, calculator | Joules' law | of equipment to be used for each experiment<br>• Relate the theory to with the experiments to be performed<br>• Assign students into groups | Digital/Analogue Multimeters, Ammeters, Voltmeters, Potentiometers, Wheatstone bridges, Rheostat, Variac, Wattmeter |
| General Objectives 4 Understand the concept of electrostatics, electric change and capacitance of capacitation | | | | | | |
| 12-15 | 4.1 Explain electric charge.<br>4.2 State unit of electric charges.<br>4.3 State Coulomb‟s law.<br>4.4 Solve problems involving coulomb‟s law.<br>4.5 Define electric field strength, electric flux density, permittivity, relative permittivity, field intensity, potential and electric flux.<br>4.6 Solve problems involving the terms in 4.5.<br>4.7 Define capacitance.<br>4.8 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and composite dielectrics.<br>4.9 Derive an expression for the capacitance of a | • Explain sources of electric charges and electrostatic charges<br>• Explain the mathematical formula for the electric charge, electrostatic charges.<br>• Explain energy stored in Capacitor<br>• Use analytical methods and scientific software to solve problems | White Board, textbooks, lecture notes, Internet sites, PC loaded with Presentation software package and connected to multimedia Projector, calculator | 4.1 Determine by experiments charging and discharging of a capacitor. | • Provide practical manuals and reporting guidelines to the students<br>• Ensure students activities are recorded in standard laboratory notebook<br>• Assess the students practical works and add appropriate comments<br>• Encourage students to be creative and innovative in their practical | Basic Electricity Trainers, Electronic Trainers, Oscilloscopes, Digital/Analogue Multimeters, Ammeters, Voltmeters, Potentiometers, Wheatstone bridges, Rheostats, Variacs, Wattmeter |

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| | capacitor with composite dielectric.<br>4.10 Derive an expression for the voltage distribution between series connected capacitors.<br>4.11 Deduce an expression for the equivalent capacitance for capacitors connected in series and in parallel.<br>4.12 Derive an expression for the energy stored in a capacitor.<br>4.13 Solve problems involving 4.8 to 4.12. | | | | works | |

Assessment: Give details of assignments to be used: Coursework/Assignments 10%; Course test 10%; Practical 40%; Examination 40%

| Type of Assessment | Purpose and Nature of Assessment | Weighting (%) |
|---|---|---|
| Examination | Final Examination (written) to assess knowledge and understanding | 40 |
| Test | At least 1 progress test for feedback. | 10 |
| Practical / Projects | To be assessed by the teacher | 40 |
| Course work/ assignment | To be assessed by the teacher | 10 |
| Total | | 100 |

| | | |
|---|---|---|
| Programme: National Diploma in Computer Engineering | Course Code: CTE | Contact Hours: 60 |
| Course: ELECTRICAL WORKSHOP PRACTICE AND TECHNOLOGY | Semester: 1 | Theoretical: 1 hours /week |
| Year: 1 | Pre-requisite: | Practical: 3 hours /week |
| Goal: This course is designed to enable the students acquire the knowledge and skill in Electrical Installation practice | | |
| General Objectives: On completion of this course the student, should be able to:<br>1. Understand the applications of wiring and safety regulations.<br>2. Know the use of electrical and electronic engineering tools and equipment.<br>3. Understand the construction and uses of different types of electrical cables and the regulations relating to their uses.<br>4. Understand various electrical wiring systems of equipment and accessories and the regulation relating to them.<br>5. Understand the testing and inspection of electrical installations. | | |

| | Theoretical Content | | | Practical Content | | |
|---|---|---|---|---|---|---|
| General Objectives 1 Understand the applications of wiring and safety regulations | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1-3 | 1.1 State the causes of hazards in electrical and electronic engineering.<br>1.2 Explain methods of preventing hazards.<br>1.3 List several important considerations and rules concerning health, safety and environment (HSE) at workplaces in Nigeria.<br>1.4 Define earth continuity conductor, earth electrode consumer"s earth terminal.<br>1.5 Explain the necessity for earthing and relevant regulation concerning earthing.<br>1.6 Explain the protection of an installation by fuse and by earth leakage circuit breaker (ELCB).<br>1.7 Distinguish between solid earthing practice and earth leakage circuit breaker protection.<br>1.8 State a number of problems associated with earth leakage circuit breakers. | • Explain causes of hazards such as lack of training, inadequate information, unsafe system of work, inadequate isolation of circuits, unsuitable test equipment, etc.<br>• Ask students to Identify causes of electrical hazards in different places<br>• Use of safety devices, etc.<br>• Explain the types and causes of burns and wounds | • Online resources, textbooks, IEE wiring regulations, Whiteboards, Multimedia projector & screen<br>• Fist Aid box<br>• Fire extinguishers | • Demonstrate (Artificial respiration) as listed in 1.12<br>• Administer first aid applicable to 1.13.<br>• Use different types of fire extinguisher. | • Illustrate first aid applicable to 1.14.<br>• Guide students to perform first aid applicable to 1.14.<br>• Demonstrate and guide students in the use of different types of fire extinguisher | • List several important considerations and rules concerning health, safety and environment (HSE) at workplaces in Nigeria |

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|---|---|---|---|---|---|---|
| | 1.9 Describe how the human body can become part of an electric circuit.<br>1.10 Explain how to prevent electric shock.<br>1.11 Explain the methods of treating electric shock<br>1.12 Describe artificial respiration:<br>i. Mouth resuscitation;<br>ii. Revised Holder Nelson resuscitation;<br>iii. External cardio compression/cardiopulmonary resuscitation<br>1.13 Identify common causes of burns and wounds.<br>1.14 List different types of fire extinguisher.<br>1.15 Explain when each in 1.14 is applicable. | | | | | |
| General objectives 2 Know the use of electrical and electronic engineering tools and equipment | | | | | | |
| 4-5 | 2.1 List the tools obtainable inside an electrician‟s toolbox.<br>2.2 Explain the use of electrical and electronic workshop tools<br>2.3 Describe procedure for carrying out routine inspection of hand tools.<br>2.4 Distinguish between a hand tool and a machine tool. | • Show the students the various electrical and electronic tools<br>• Explain the between a hand tool and a machine tool. | • Online resources, textbooks, IEE regulations, Whiteboards, Multimedia projector & screen | • Identify different types of electrical and electronic tools<br>• Use common workshops tools and equipment. | • Demonstrate the use of different types of electrical and electronic tools<br>• Assign students into groups<br>• Provide practical manuals to | Explain the use of Electrical and Electronic Toolboxes<br><br>List and explain different hand and machine tools |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | students<br>• Ensure that the workshop is safe for use<br>• Ensure that all tools and materials to be used have been provided | |
| | GENERAL OBJECTIVES 3: Understand the construction and uses of different types of cables and the regulations relating to their uses. | | | | | |
| 6-7 | 3.1 List the types of insulating and conducting materials.<br>3.2 Distinguish between conductors and insulators.<br>3.3 Describe, with the aid of sketches, the construction of different types of cables.<br>3.4 State the advantages and disadvantages when using:<br>i. P.V.C- insulated, P.V.C -sheathed cables.<br>ii. Mineral-Insulated metal-sheathed cables.<br>iii. Armoured P.V.C-Insulated, PVC sheathed cables.<br>iv. Steel and PVC conducts. | • Describe, with the aid of sketches, different types of cables.<br>• Explain IEE regulations in relation to cables<br>• Describe the various colour codes use for cable used in Nigeria<br>• Use current IEE wiring regulations to teach the students<br>• Give assignments to students on cable | • Online resources, textbooks, IEE wiring regulations, Whiteboard, Multimedia projector & screen<br>• Various sizes of cable, Cable sample Board, Electrical/Electronic toolboxes | • Identify different types of cables<br>• Perform various types of joints using PVC and other cables | • Show the student different types of cables<br>• Ask the students to identify different types of cables<br>• Show the student cables with different colour<br>• Ask the students to identify different colours for live neutral and earth. | Distinguish between conductors and insulators<br>List out the advantage of the following:<br><br>State the advantages and disadvantages when using:<br>vii. P.V.C-insulated, P.V.C -sheathed cables.<br>viii. Mineral-Insulated metal-sheathed cables.<br>ix. Armoured |

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| | v. Steel and PVC trunking.<br>vi. Flexible cable and cord etc.<br>3.5 Explain the general IEE wiring regulations related to cables and their uses.<br>3.6 Identify the cable colour coding, commonly used in Nigeria. | classification and their uses | | | • Offer support to groups of students<br>• Assess the students performance during the practical classes and their reports | P.V.C-Insulated, PVC sheathed cables.<br>x. Steel and PVC conducts. |
| | GENERAL OBJECTIVES 4: Understand various electrical wiring systems of equipment and accessories and the regulation relating to them. | | | | | |
| 8-13 | 4.1 Identify different wiring methods such as conduits, ducts, trunking and surface etc<br>4.2 List factors associated with the choice of a particular wiring system.<br>4.3 State the uses of pattresses and blocks for electrical wiring.<br>4.4 Illustrate Installation of electrical accessories such as plugs, adaptor, ceiling roses, sockets switches etc using wiring methods<br>4.5 Describe 2-way switches with two intermediate switches to control various lighting points,<br>4.6 Discuss wiring of electric bell-indicator and alarm circuits, ELCB, domestic ring main circuit, consumer | • Explain wiring methods<br>• Discuss factors considered in the choice of wiring systems<br>• Ask to identify and draw electrical accessories such as plugs, adaptor, ceiling roses, sockets switches<br>• Sketch 2-way switches with two intermediate | • Online resources, textbooks, IEE wiring regulations, Whiteboard, Multimedia projector & screen<br>• Conduits, ducts, trunking , Electrical accessories and consumables, wiring boards, Wooden simulation walls, Electrical/Electronic toolboxes, circuits, ELCB,<br>• cooker control unit, | • Install electrical accessories such as plugs, adaptor, ceiling roses, sockets switches etc. using different wiring methods<br>• Wire 2-way switches with two intermediate switches to control | • Assign students into groups<br>• Provide practical manuals to students<br>• Ensure that the workshop is safe for use<br>• Ensure that all tools and materials to be used have been provided. | Illustrate Installation of electrical accessories such as plugs, adaptor, ceiling roses, sockets switches etc using wiring methods |

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| | control units<br>4.7 Describe the distribution of power in a consumer premises employing single phase, four wire systems.<br>4.8 State the regulation relating to 4.5 to 4.7 above<br>4.9 Describe the steps for preparing requisition for wiring materials.<br>4.10 Explain the modular wiring systems and accessories | switches to control various lighting points,<br>• Sketch wiring of electric bell-indicator and alarm circuits, ELCB, domestic ring main circuit, consumer control units<br>• Explain single phase, four wire systems and three phase supply for residential buildings<br>• Discuss various software packages to draw and simulate and electrical wiring system.<br>• Discuss the modular | | various lighting points<br>• Wire electrical bell, bell-indicator and alarm circuits, ELCB, domestic ring main circuit cooker control unit, consumer control unit and discharge lamps.<br>• Distribute power in a consumer premises employing single phase four wire systems, Prepare requisition for wiring | | |

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| | | wiring system | | materials. | | |
| | GENERAL OBJECTIVES 5: Understand the testing and inspection of electrical installations | | | | | |
| 14-15 | 4.1 State basic requirements for testing and inspection of electrical installation.<br>4.2 Draw the electrical diagrams of testing procedures.<br>4.3 List various instruments for carrying out testing and inspection work.<br>4.4 Explain the following test:<br>i. Polarity;<br>ii. Continuity test;<br>iii. Insulation resistance test;<br>ivTest of ring circuit continuity;<br>v Test of effectiveness of earthing | • Mention requirements for testing and inspection of electrical installation.<br>• Sketch the electrical diagrams of testing procedures.<br>• Discuss the following test as listed in 4.4<br>• Discuss various software packages to draw and simulate and electrical wiring system | • Online resources, textbooks, IEE wiring regulations, Whiteboard, Multimedia projector & screen<br>• Megger, Multimeter, earth loop tester | • Demonstrate the test listed in 4.4.<br>• Guide the students to carry out the test in 4.4 | • Offer support to groups of students<br>• Assess the students performance during the practical classes and their reports.<br>• Provide practical manuals to students<br>• Ensure that the workshop is safe for use<br>• Ensure that all tools and materials to be used have been provided | Megger, Multimeter, earth loop tester<br>Explain the following test:<br>i. Polarity;<br>ii.Continuity test;<br>iii. Insulation resistance test;<br>ivTest of ring circuit continuity;<br>v Test of effectiveness of earthing |

Assessment: Give details of assignments to be used: Coursework/Assignments 10%; Course test 10%; Practical 60%; Examination 20%

| Type of Assessment | Purpose and Nature of Assessment | Weighting (%) |
|---|---|---|
| Examination | Final Examination (written) to assess knowledge and understanding | 20 |
| Test | At least 1 progress test for feedback. | 10 |

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| Practical / Projects | To be assessed by the teacher | 60 |
| Course work/ assignment | To be assessed by the teacher | 10 |
| Total | | 100 |

ND I SECOND SEMESTER

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| Programme: National Diploma in Computer Engineering | | Course Code: EEC 124 | | Contact Hours: 45 |
| Course: Electronic I | | Semester: 1 | | Theoretical: 1 hours /week |
| Year: 1 | Pre-requisite: | | | Practical: 2 hours /week |
| Goal: This course is intended the student with basic knowledge of thermionic and semi-conductor devices. | | | | |
| GENERAL OBJECTIVES:<br>On completion of this module, the student should be able to:<br>1. Understand the basic science of electricity and electronics.<br>2. Understand the simple concept of basic instruments and measurements<br>3. Introduction to basic electrical Circuit Material<br>4. Know the operations, characteristics and applications of semi-conductor devices.<br>5. Understand the constructional features and configuration of bipolar junction transistors<br>6. Understand how the triode and the bipolar transistor can be used as a single stage amplifier.<br>7. Understand the zener diode and thyristor as switching devices.<br>8. Understand the constructional features and operation of a field-effect transistor (FET) | | | | |

| | Theoretical Content | | | Practical Content: Course Code: EEC 124 | | |
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| | GENERAL OBJECTIVES 1: Understand the concept of thermionic emission. | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Practical Outcomes | Instructor"s Activities | Evaluation |
| 1 - 3 | 1.1 Explain the history of electronics<br>1.2 Discuss the process of thermionic emission<br>1.3 Describe the applications of the thermionic valves<br>1.4 Explain the disadvantages and advantages of items listed in 1. Above<br>1.5 Explain the construction and principles of thermionic valves | • Trace the evolution development of electronics<br>• Identify the applications of the following thermionic valves:<br>o Diode<br>o Triode<br>o Tetrode<br>o Pentode<br>o Hexode<br>o Heptode<br>o Octode<br>• Make slide presentations on thermionic valves<br>• Discuss recent trends in electronics | • Textbooks, multimedia projectors and screen, online resources, lecture notes, Charts, writing materials. | | | Explain the thermionic emission using the applications of the following thermionic valves:<br>o Diode<br>o Triode<br>o Tetrode<br>o Pentode<br>o Hexode<br>o Heptode<br>o Octode |
| General Objectives 2 Understand the simple concept of energy level in materials | | | | | | |
| 4 - 5 | 2.1 Outline energy levels in materials.<br>2.2 Explain valence and conduction bands.<br>2.3 Explain Fermi energy levels.<br>2.4 Distinguish between conductors, semiconductors and insulators, using Fermi- | • Illustrate energy<br>• levels in materials.<br>• Explain Fermi energy levels.<br>• Give examples of<br>• conductors, semiconductors and insulators<br>• Explain holes and | • Textbooks, multimedia projectors and screen, online resources, lecture notes, Charts, writing materials. | | | Explain valence conductors, semiconductors and insulators, using Fermi-level concept. |

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| | level concept.<br>2.5 Explain intrinsic and extrinsic semiconductors.<br>2.6 Explain carriers in semi-conductors.<br>2.7 Define majority and minority carriers.<br>2.8 Outline the effect of temperature on the conductivity of semi-conductors and conductors. | electronics in semi-conductors.<br>• Highlight new findings in semiconductor technologies<br>• Give assignment to students on semiconductor devices. | | | | Explain the effect of temperature on the conductivity of semi-conductors and conductors. |
| General Objectives 3 Know the operations, characteristics and applications of semi-conductor devices | | | | | | |
| 6 - 7 | 3.1 Explain P-N junction diode (Forward and Reverse bias).<br>3.2 Sketch forward and reverse characteristics of the P-N junction diode.<br>3.3 Explain silicon and germanium diode characteristics.<br>3.4 Explain zener diode characteristics.<br>3.5 Identify the circuit symbols for diode.<br>3.6 Identify various types of diodes physically.<br>3.7 Explain the following:<br>i. The zener effect; and<br>ii. Avalanche effect.<br>3.8 State application of zener diode (clipping, stabilization etc.)<br>3.9 Explain the operation, | • Discuss the application of P-N junction diode in practical systems<br>• Solve problems on the P-N junction diode (Forward and Reverse bias)<br>• Discuss silicon and germanium diode.<br>• Introduce various types of diodes and analyze the use | • Textbooks, electronic books, projector and lecture notes.<br>• Charts writing materials.<br>• Practical manual and report book, electronic/ white board, projector and practical manual.<br>• Charts writing materials. | • Perform experiment to determine V-I characteristics of the Silicon P-N junction diode.<br>• Perform experiment to determine V-I characteristics of the zener diode. | • Demonstrate the P-N junction diode in practical systems using application<br>• Solve problems on the P-N junction diode (Forward and Reverse bias)<br>• Discuss silicon and germanium diode.<br>• Introduce various types of diodes and analyze the use | Explain the characteristics of silicon and germanium diode, zener diode<br><br>Expalain the circuit symbols for diode and its types. |

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| | using the characteristics and symbol of the following:<br>i. Tunnel diode;<br>ii. Photo diode;<br>iii. Thermistors.<br>3.10 State the applications of (i) to (iii) in 3.9 above. | | | | | |
| General Objectives 4 Understand the constructional features and configuration of bipolar junction transistors | | | | | | |
| 8 - 9 | 4.1 Explain the structure and operation of a bipolar transistor (NPN and PNP).<br>4.2 Explain the biasing arrangement of NPN and PNP bipolar transistors.<br>4.3 Explain the circuit configuration of NPN and PNP bipolar transistors and their biasing arrangement:<br>i. The common base configuration.<br>ii. The common collector configuration.<br>iii. The common emitter configuration.<br>4.4 Sketch the static characteristics curves of NPN and PNP bipolar transistors for 4.3 (i) and 4.3 (iii).<br>4.5 Explain the input and output resistances, current and voltage gains from 4.4. | • Discuss the application of a bipolar transistors in practical systems (PNP and NPN)<br>• Solve problems on the bipolar junction transistors<br>• Use appropriate circuit diagrams to discuss the applications and operational principle of thy NPN and PNP bipolar<br>• Demonstrate the use of input and output resistances gains from NPN and PNP bipolar transistor<br>• Draw the characteristic curve of NPN and PNP transistors | • Textbooks, electronic books, projector and lecture notes.<br>• Charts writing materials.<br>• Practical manual and report book, Electronic trainers, circuit construction boards/decks, electronic components, power supply, oscilloscopes, multimeter, electronic/ white board, projector, practical manual, charts and writing materials. | • Determine the input and output resistances, current and voltage gains from 4.4.<br>• Determine by experiments the characteristic curve of NPN and PNP transistors. | • Demonstrate the operation of bipolar transistors (NPN and PNP).<br>• Illustrate bipolar transistors in practical systems (PNP and NPN)<br>• Guide students to use appropriate circuit diagrams to discuss the applications and operational principle of thy NPN and PNP bipolar<br>• Demonstrate the use of input and output resistances gains from NPN | Explain the structure and operation of a bipolar transistor (NPN and PNP),<br>-the biasing arrangement of NPN and PNP bipolar transistors:<br>iThe common base configuration.<br>ii. The common collector configuration.<br>iii. The common emitter configuration |

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| | 4.6 Explain the characteristic curve of NPN and PNP transistors. | • Highlight current development in bipolar junction transistor<br>• Discuss the factors for setting up semi-conductor industry | | | and PNP bipolar transistor<br>• Draw the characteristic curve of NPN and PNP transistors | |
| General Objectives 5 Understand how the triode and the bipolar transistor can be used as a single stage amplifier | | | | | | |
| 10-11 | 5.1 Explain the fixed biasing arrangement of a single state transistor amplifier.<br>5.2 Explain how to draw the load line (D.C & A.C.) output characteristic curve of a bipolar transistor.<br>5.3 Explain how to use the characteristic curves to determine the following:<br>i. A.C current gain;<br>ii. A.C. Voltage gain<br>iii. A.C. Power gain | • Explain basic circuit schematics<br>• Discuss breadboards and multisim exercises<br>• Explain the use of characteristic curves to determine A.C current gain, voltage gain and power gain. | • Textbooks, electronic books, projector and lecture notes.<br>• Charts writing materials.<br>• Practical manual and report book, Electronic trainers, circuit construction boards/decks, electronic components, power supply, oscilloscopes, multimeter, electronic/ white board, projector, practical manual, charts and writing materials. | • Determine by experiment the voltage gain of a common emitter. | • Explain the procedures to be followed to the students<br>• Assign students into groups | Draw the load line (D.C & A.C.) output.<br>List the characteristic curve of a bipolar transistor.<br>Explain the use of the following:<br>i. A.C current gain;<br>ii. A.C. Voltage gain<br>iii. A.C. Power gain |

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| General Objectives 6 Understand the zener diode and thyristor as switching devices | | | | | | |
| 12-13 | 6.1 Explain basic structure of the thyristor and the zener diode.<br>6.2 Explain the working principle of the thyristors and the zener diode.<br>6.3 List the application of the thyristor and the zener diode.<br>6.4 State the advantages of the thyristor switch over other types of electromechanical switches e.g. relay mechanical switches.<br>6.5 Explain the operation of zener diode as voltage stabilizer. | • Analyze the structure of the thyristor and the zener diode<br>• Explain different types of thyristor and the zener diode application<br>• Discuss software packages to analyse and simulate electronic components and devices<br>• | • Textbooks, electronic books, projector and lecture notes.<br>• Charts writing materials.<br>• Practical manual and report book, Electronic trainers, circuit construction boards/decks, electronic components, power supply, oscilloscopes, multimeter, electronic/ white board, projector, practical manual, charts and writing materials. | • Verify by experiment the operation of a zener diode as a voltage stabilizer. | • Assign students into groups<br>• Provide practical manuals and reporting guidelines to the students<br>• Ensure students activities are recorded in standard laboratory notebook<br>• Assess the students practical works and add appropriate comments | • List the advantages of the thyristor switch over other types of electromechanical switches. |
| General Objectives 7 Understand the constructional features and operation of afield-effect transistor (FET) | | | | | | |
| 14-15 | 7.1 Explain the basic constructional features of FETs.<br>7.2 Explain the different between depletion and enhancement modes.<br>7.3 Plot the output and transfer characteristics | • Explain the basic operation of junction gate and insulated v gate<br>• Differentiate between depletion and data<br>• Outline and explain | • Textbooks, electronic books, projector and lecture notes.<br>• Charts writing materials. | • Determine by experiment, the output characteristic of a common source FET.<br>• Obtain voltage gain, input and | • Explain the procedures to be followed to the students<br>• Identify the set of | |

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| | from given data.<br>7.4 State the precautions necessary when using FETs.<br>7.5 Describe the output characteristic of a common source of FETs.<br>7.6 Explain voltage gain, input and output resistance from output characteristic in 7.6 above.<br>7.7 Compare the properties of a FET with that of a triode valves and bipolar transistors.<br>7.8 Explain the use of bipolar and FET as switching devices using characteristics curves. | the precautions necessary whey using field-effect transistor (FET)<br>• Discuss software packages to analyse and simulate electronic components and devices<br>• Discuss new variants of FETs | | output resistance from output characteristic in 7.6 above. | equipment to be used for each experiment<br>• Relate the theory to the experiments to be performed<br>• Assign students into groups | Compare the properties of a FET with that of a triode valves and bipolar transistors.<br><br>What is the use of bipolar and FET as switching devices using characteristics curves |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 121 | CREDIT HRS: 75 HRS<br>15 WEEK |
| COURSE: DIGITAL FUNDAMENTAL I | COURSES UNIT 4.0 | |
| Semester 3 | | |

Goal: This course is designed to provide students with the knowledge of the principles of bistable or flip-flop in the operations and applications of logic devices.

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

1. Understand the features of different logic gates and the sequence and data flow controls
2. Understand basic principle of bistable elements and the principle of counter and register
3. Know the implementation of the addition operation in the computer and digital circuit components.
4. Understand the characteristic of basic digital devices and the design and construction of simple combinational logic circuits using the basic devices.
5. Understand the operation of bistable elements and simple sequential circuit.

| Programme: National Diploma in Computer Engineering | | | Course code: CTE 121 | | Contact Hours: |
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| Course: Digital Fundamental I | | | | | Theoretical: 3 |
| Year: Two Semester: Three | | | Pre-requisite: None | | Practical: 1 |
| General Objective 1.0: Understand the features of different logic gates and the sequence and data flow controls | | | | | |
| Week | Theoretical Content | | | Practical Content | | |
| | Specific Learning Objectives | Teacher"s activities | Resources | Specific Learning Objectives | Teacher"s activities | Evaluation |
| 1-4 | 1.1 Explain the principle of operation of combinational logic..<br>1.2 Write down a logical sum of product equations.<br>1.3 Draw circuit diagram that implements the equation above. Using : AND,OR,NOT gates.i) NAND ii) NOR iii) Exclusive-OR iv) Exclusive-NOR functions.<br>1.4 Design logic circuits using a combination of | • Give the<br>• format of all the<br>statements.<br>• Write<br>• sample program<br>containing all the<br>statements<br>• Write<br>• sample format statement. | PC Loaded with Instructional manual, Compiler, Power point package and connected to an OHP PC in a networked laboratory Loaded with Compiler, and Power point package and connected to Internet | Run simple logical statement using DO-WHILE and NEXT LOOP statement.<br>Illustrate the action of gates using truth-table. | Assist student in<br>running simple java program using DO-WHILE and NEXT LOOP statement.<br>And Illustrate the action of gates using truth-table. | Explain the principle of operation of combinational logic.<br>Design logic circuits using a<br>combination of logic gates |

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| | logic gates.<br>1.5 Describe the action of the Diode.<br>1.6 Describe the construction of the AND, or OR gates using diode. | | | | | |
| General objectives 2 Understand basic principle of bistable elements and the principle of counter and register | | | | | | |
| | 2.1 Define a bistable (flip flop).<br>2.2 Describe the action of a flip flop.<br>2.3 Describe the operation of the following bistables elements: i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip-flop(toggle flip-flop),JK-flip-flop.<br>2.4 Explain the function of preset and clear of the bistable element.<br><br>2.5 Describe some specific I.C bistable elements e.g i) SN | • Give the general format of<br><br>Flip-flop.<br><br>• identify different types of bistable elements.<br><br>•Explain the operation of different modules e.g mod-6,mod10 and mod-12.<br><br>Explain the operation of the basic binary ripple counter and the up and down counters,<br><br>Explain a shift-left, a shift-right and shift round registers.<br>and the parallel transfer of data through registers. | PC<br>Loaded with Instructional manual, Compiler, Power point package and connected to an OHP PC in a networked laboratory Loaded with Compiler, and Power point package and connected to Internet<br>. | -Identify operation of register and counters.<br><br>- Observe the operation of the following bistables elements: i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip-flop(toggle flip-flop),JK-flip-flop. | Aassist student to identify different families of flip-flop, ICs families and<br><br>Observe the operation of the following bistables elements: i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip-flop(toggle flip-flop),JK-flip-flop. | Explain the operation of the following bistables elements: i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip-flop(toggle flip-flop),JK-flip-flop. |

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| | 7474 ii) SN 7476.<br><br>2.6 Describe the operation of the basic binary ripple counter.<br><br>2.7 Describe the operation of up and down counters<br><br>2.8 Describe the operation of the modules counter using as example Mod-10, Mod-12, and Mod-6 counters.<br><br>2.9 Define a shift-left, a shift-right and shift round registers.<br><br>2.10 Describe the parallel transfer of data through registers.<br>2.11 Describe the serial-parallel transfer operation. | . | | | | |
| General Objectives 3 Know the implementation of the addition operation in the computer and logical circuit components | | | | | | |
| | 3.1 Describe the serial adder | • -Illustrate events | PC<br>Loaded with | -Connect a simple Logical | Guide students to connect to a simple | Explain the serial adder, the |

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| | 3.2 Describe the parallel adder<br>3.3 Describe the half-adder<br>3.4 Describe the full-adder<br>3.5 Describe different logic element<br>3.6 Identify AND,OR,NOT, NAND and XOR gates | driven<br><br>Counters and registers with examples.<br><br>• -Ask students to draw the<br><br>Examples of adders.<br><br>• -Give programming<br><br>exercise on event driven<br><br>programs. | Lecture materials, Power point package and connected to an OHP<br>PC in a networked laboratory Loaded with and Power point package and connected to Internet | circuit.<br><br>-identify different logic gates. | java event driven program | parallel adder, the half-adder And the full-adder.<br><br>Explain different logic element<br>Identify AND,OR,NOT, NAND and XOR gates |
| General Objectives 4 Understand the characteristic of basic digital devices and the design and construction of simple combinational logic circuits using the basic devices. | | | | | | |
| | Be able to:<br><br>4.1 Describe the operation of different logic elements e.g AND, OR,NOT,NOR, NAND, and XOR gates.<br>4.2 Analyse the circuit diagram that implement various circuit combinations.. | • Show the students different types of logic gates.<br><br>• Draw their circuit diagram.<br><br>•<br><br>• assignment to cover topics.<br><br>• Questions and Answer<br><br>• sessions. | PC Loaded with Lecture materials, Power point package and connected to an OHP<br>PC in a networked laboratory Loaded with and Power point package and connected to | Demonstrate the operation of combinational of logic function.<br><br>Demonstrate practically the logic AND,OR,NOT using i) Logic gates ii) Discrete elements. | Guide students to demonstrate the operation of combinational of logic function. | Describe the operation of different logic elements. |

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| | | | Internet | | | |
| General Objectives 5 Understand the operation of bistable elements and simple sequential circuit | | | | | | |
| 14-15 | 5.1 Draw some specific IC bistable elements e.g SN 7474, SN 7476.<br>5.2 Construct the elements in above.<br>5.3 Analyse the design techniques of sequential circuits. | • show the students different types of ICs.<br>• show them SN 7474 series and 7476 series of ICs.<br>•<br>• assignment to cover topics.<br>• Questions and Answer<br>• sessions. | PC Loaded with Lecture materials, Power point package and connected to an OHP<br>PC in a networked laboratory Loaded with and Power point package and connected to Internet | Perform experiments to illustrate sequential circuit (counters, registers) using the various bistable elements<br>Draw some specific IC bistable elements e.g SN 7474, SN 7476.<br>Construct the elements in above | • show the students different types of ICs.<br>• show them SN 7474 series and 7476 series of ICs.<br>•<br>• assignment to cover topics.<br>• Questions and Answer<br>• sessions - | Explain the design techniques of sequential circuits. |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING | CODE: EEC 235 | CREDIT HRS: 60 HRS |
| COURSE: ELECTRICAL MEASUREMENT & INSTRUMENTATION II | COURSES UNIT 2.0 | |
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Goal: This course is designed to enable the student select, connect and use electronic/electrical instruments for measurement of physical quantities.

GENERAL OBJECTIVES:

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

1. Understand the use of different types of meters for measuring power and power factor.
2. Understand the use of different types of bridges (a.c. and d.c.).
3. Understand the principle of operation of a fluxmeter and its application.
4. Understand the principle and use of digital instruments.
5. Know the various factors which should be considered when selecting an instrument.
6. Understand the main types of measurements and measuring instruments.

| Theoretical Content | | | | | | |
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| General Objectives 1 Understand the use of different types of meters for measuring power and power factor | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1 – 3 | 1.1 Explain the electrodynamics principles of different types of power measurement.<br>1.2 Describe the operation of electrodynamics wattmeter and power factor meter.<br>1.3 Explain the induction principle of power measurement.<br>1.4 Describe the induction wattmeter.<br>1.5 Describe the use of two wattmeter for power measurement in a 3 phase circuit.<br>1.6 Measure Power in:<br>a. Single phase circuit;<br>b. 3 phase circuit, using wattmeter and p.f. meters | - Explain the circuit structure of wattmeter and power factor meter<br><br>Explain the circuit for power measurement using wattmeter and power factor meter | Chalk, Board, recommended textbook,.<br><br>Power supplies, Wattmeter and power factor meter | Use wattmeter to measure power in ac and dc circuits. | - Demonstrate the use of wattmeter for power measurement in single-phase circuit.<br>- Demonstrate the use of two wattmeters for power measurement in 3-phase circuits | Explain the induction principle of power measurement in<br>a. Single phase circuit;<br>3 phase circuit, using wattmeter and p.f. meters |
| General Objectives 2 understand the use of different types of bridges (A.C and D.C) | | | | | | |
| | 2.1 Explain the term null indicator.<br>2.2 Describe the expression for the | - Explain the types and uses of various electrical bridge in 2.1 to 2.8 in column | Chalk, Board, recommended textbook. | Use Wheatstone bridges for accurate measurements. | - Demonstrate the use of dc and ac bridges to measure<br>- resistance | Explain the term null indicator and the expression for |

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| 4 – 6 | measurement of an unknown resistance by Wheatstone bridge circuit.<br>2.3 Derive the expression for the measurement of an unknown resistance by Wheatstone bridge circuit.<br>2.4 Describe the Carey Foster"s slide wire bridge.<br>2.5 Explain the structure of the following ac bridges<br>Wien bridge<br>Maxwell"s bridge<br>Schering bridge<br>Hay bridges bridge<br>2.6 Derive expressions for the measurement of unknown capacitance or inductance using the bridges in 2.5 above.<br>2.7 Explain, how a.c. bridge can be used to measure;<br>i. Resistance;<br>ii. Inductance;<br>i. Capacitance;<br>iv. Frequency<br>2.8 Measure the items listed in 2.5 above. | 2; | Power supplies, Wattmeter and power factor meter | | - capacitance<br>- inductance<br>- frequency<br><br>- Give the students experiments to measure the above basic circuit parameters | the measurement of an unknown resistance by Wheatstone bridge circuit.<br><br>Explain how to derive the expression for the measurement of an unknown resistance by Wheatstone bridge circuit. |
| General Objectives 3 Understand the principle of operation of a fluxmeter and its application | | | | | | |

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| 7 – 8 | 3.1 Describe the constructional features of a fluxmeter.<br>3.2 Explain the principle of operation of a fluxmeter.<br>3.3 Explain the use of a fluxmeter for drawing B H curves.<br>3.4 Determine by experiments the B.H curves for different magnetic materials using a flux meter. | Explain the importance of B-H curves for magnetic materials | Chalk, Board, recommended textbook. | | - Draw the B-H curves for magnetic materials using values measured with flux meter | |
| General Objectives 4 Understand the principle and use of digital instruments | | | | | | |
| 9 – 10 | 4.1 Explain with aid of block diagram the working principles of a digital voltmeter and ammeter.<br>4.2 Explain how the DVM can be used to measure:<br>a. Voltage;<br>b. Current;<br>c. Resistance.<br>4.3 State the limitations of the DVM for measuring high frequency signals.<br>4.4 Explain with aid of a block diagram, the working principle of a digital frequency meter. | - Give the essential features of digital instruments.<br>- Emphasize the advantages and limitations of digital instruments compared to analogue instruments<br><br>Explain the advantages of digital meters and electromechanical measuring instruments | Chalk, Chalkboard, Notes, recommended textbook. | Use measuring instrument to measure voltage, current, frequency and resistance | Demonstrate how to measure voltage, current using digital instruments | Explain how the DVM can be used to measure:<br>a. Voltage;<br>b. Current;<br>c. Resistance.<br><br>Explain the limitations of the DVM for measuring high frequency signals |

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| | 4.5 State advantages of digital meters over other electromechanical measuring instruments.<br>4.6 Measure Voltage, current and frequency using digital instruments. | | | | | |
| General Objectives 5 Know the various factors which should be considered when selecting an instrument | | | | | | |
| 11 – 12 | 5.1 Explain the importance of the following instruments for measurement<br>i. Range.<br>ii. Accuracy.<br>iii. Response.<br>iv. Input.<br>v. Stability.<br>vi. Operation.<br>vii. Reliability.<br>viii. Sensitivity. | Explain the importance of Range.<br>Accuracy.<br>Response.<br>Input.<br>Stability.<br>Operation.<br>Reliability.<br>Sensitivity<br><br>Explain the effect of various instruments parameters on the measure and | Chalk, Chalkboard, Notes, recommended textbook | | | List the importance of the following instruments for measurement<br>i. Range.<br>ii. Accuracy.<br>iii. Response.<br>iv. Input.<br>v. Stability.<br>vi. Operation.<br>vii. Reliability.<br>Sensitivity |
| General Objectives 6 Understand the main types of measurements and measuring instruments | | | | | | |
| 13 – 15 | 6.1 Explain instrumentation and its importance.<br>6.2 Explain the working principles and uses of the following instruments: | Explain instrument classifications.<br><br>Explain the working principles and uses of measuring instruments | - Ditto - | | | Explain the working principles and uses of the following instruments:<br>d. Indicating instrument; |

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| | a. Indicating instrument;<br>b. Recording instrument;<br>c. Controlling instruments<br>6.3 Differentiate the instruments stated in 6.2 above, giving example of each.<br>6.4 Calibrate each types of instrument in 6.2 | | | | | e. Recording instrument;<br>f. Controlling instruments |

ND 1 THIRD SEMESTER

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING | CODE: CTE 239 | CREDIT HRS: 30 HRS |
| COURSE: ELECTRICAL CIRCUIT THEORY I | COURSES UNIT 2.0 | |
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Goal: This course is designed to provide students with basic knowledge in electric circuit analyses.

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

1. Understand the Kirchhoff's laws and their application in solving d.c electrical problems.
2. Understand a.c theory and apply it to the solution of simple electrical circuit.
3. Understand Mesh and Nodal analyses and their applications in solving electrical problems.
4. Understand Network transformation and Duality principles.
5. Understand Network theorems and their applications d.c and a.c circuits.

| Theoretical Content | | | | | | |
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| General Objectives 1 Understand the Kirchhoff"s laws and their application in solving D.C electrical problems | | | | | | |
| | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1 | 1.1 Explain Kirchhoff"s voltage and current laws.<br>1.2 Derive formulae for series and parallel circuit with respect to total current and voltage drop.<br>1.3 Solve problems on Kirchhoff"s laws. | Revise Kirccoff"s laws and derivation of its formulae with solving problems on them. | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | State Kirchhoff"s voltage and current laws.<br><br>Derive formulae for series and parallel circuit with respect to total current and voltage drop. |
| General Objectives 2 Understand A.C. theory and apply it to the solution of simple electrical circuits | | | | | | |
| 2 - 5 | 2.1 State different mathematical forms of representing a.c. signal e.g. trigonometry polar and j-notation.<br>2.2 Convert a.c. signal in polar form to the j-notation.<br>2.3 Subtract, add, multiply and divide phasor using j-operator.<br>2.4 Solve simple problems using j-notation.<br>2.5 Draw to scale phasor diagrams for a.c. circuits.<br>2.6 Show with the aid of phasor diagrams that the current in | • Explain the a.c theory with respect to serial and parallel circuit<br>• Solve many problems involving a.c theory and circuits | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | Solve some simple Mathematical Problem using using j-notation.<br><br>Explain with the aid of phasor diagrams that the current in a capacitor circuit |

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| | a capacitor circuit leads the voltage and the current in the inductive circuit lags the voltage.<br>2.7 Distinguish between inductive and capacitive reactance.<br>2.8 Draw voltage and current wave forms on same axis to show lagging and leading angles.<br>2.9 Draw the phasor diagrams for series and parallel a.c. circuits.<br>2.10 Calculate voltage, current power and power factor in series and parallel circuits.<br>2.11 Explain series and parallel resource.<br>2.12 State conditions for series and parallel resource.<br>2.13 Prove the relevant formulae for 2.12 above e.g. q-factor, dynamic impedance, bandwidth, resonance frequency.<br>2.14 Sketch I and Z against F for series and parallel circuits where I=current, Z= impedance, F= frequency.<br>2.15 Calculate the Q-factor for a coil; loss factor for a capacitor.<br>2.16 Explain, with the aid of a diagram, bandwidth.<br>2.17 Solve problems involving | | | | | leads the voltage and the current in the inductive circuit lags the voltage.<br><br>Differentiate between inductive and capacitive reactance. |

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| | bandwidth and circuit Q-factor | | | | | |
| General Objectives 3 understand Mesh and Nodal analyses and their applications in solving electrical problems | | | | | | |
| 6 – 8 | 3.1 Explain the following terms used in electric network:<br>i. Active element/circuit e.g. battery/circuit containing a battery etc.<br>ii. Passive Element/circuit e.g. resistor/a source less circuit.<br>iii. Branch.<br>i. Node.<br>ii. Loop;<br>iii. Network.<br>3.2 Explain the basic principle of melh circuit analysis.<br>3.3 Solve problem on items listed in 3.2 above.<br>3.4 Explain the basic principle of Nodal analysis.<br>3.5 Solve problem on 3.4 above. | • Analyze nodal/mesh network circuits<br>• Solve nodal/mesh network circuits | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | Explain the basic principle of melh circuit analysis. And the basic principle of Nodal analysis. |
| General Objectives 4 understand Network transformation and duality principles | | | | | | |
| 9 - 11 | 4.1 Reduce a complex network to its series or parallel equivalent.<br>4.2 Identify star and delta networks.<br>4.3 Derive the formula for transformation of a delta to a star network and vice-versa.<br>4.4 Solve problems on 4.3 above.<br>4.5 Explain the meaning of Duality principle.<br>4.6 Prove duality between resistance, conductance, | • Solve network problems with duality principle | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | Explain the process to derive the formula for transformation of a delta to a star network and vice-versa |

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| | inductance, capacitance, voltage-current.<br>4.7 Find the dual of network.<br>4.8 Solve network problems using duality principle | | | | | |
| General Objectives 5: Understand Network theorems and their applications D.C. and A.C circuits | | | | | | |
| 12 - 15 | 5.1 State Thevenin‟s Theorem.<br>5.2 Explain the basic principle of Thevenin‟s theorem.<br>5.3 Solve problems on simple networks using Thevenin's theorem.<br>5.4 Solve problems involving repeated use of Thevenin's theorem.<br>5.5 State Norton's Theorem.<br>5.6 Explain the basic principle of Norton‟s Theorem.<br>5.7 Compare Norton's theorem with Thevenin‟s theorem.<br>5.8 Solve problem using Norton's theorem.<br>5.9 State Millman‟s theorem.<br>5.10 Explain the basic principle of Millman‟s theorem.<br>5.11 Solve network problems using Millman‟s theorem.<br>5.12 State reciprocity theorem.<br>5.13 Explain the basic principle of reciprocity theorem.<br>5.14 Solve network problems using Reciprocity theorem | • Explain the Thevenin's and Norton's theorem to solve electric circuits/networks problems<br>• Solve network problems using Millman's theorem and Reciprocity theorem | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | State Thevenin‟s Theorem and explain the basic principle of Thevenin‟s theorem |

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| Programme: National Diploma in Computer Engineering Technology | Course Code: EEC 234 | Contact Hours: 60 Hours |
| Course: ELECTRONIC II | Semester: 3 | Theoretical: 2 hours /week |
| Year: II | Pre-requisite: Electronic I | Practical: 2 hours /week |
| Goal: This course is designed to enable students to acquire the basic knowledge operation of amplifier, oscillators, switching circuits and power supplies | | |
| GENERAL OBJECTIVES:<br>On completion of this module, the student should be able to:<br>1. Understand the operation of signal amplifiers.<br>2. Understand the general principles of feedback and oscillators.<br>3. Apply the principles of switching circuits.<br>4. Know the action of basic electronic logic gates.<br>5. Understand the basic circuits used in power supplies. | | |

| | Theoretical Content | | | Practical Content | | |
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| | GENERAL OBJECTIVE 1: Understand the operation of signal amplifiers. | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1-3 | 1.1 Explain different types of biasing arrangement of transistor amplifier.<br>i. Fixed bias.<br>ii. Collector-base bias without and with a decoupling capacitor.<br>iii. Potential divider bias.<br>iv. Junction FET simple bias.<br>1.2 Draw the circuit diagram of a single stage common emitter and source transistor amplifiers having resistive load, transformer and tuned circuit loads.<br>1.3 Calculate the voltage and power gains of the amplifiers in 1.2 above.<br>1.4 Explain the principle of operation of the circuit in 1.2 above.<br>1.5 Explain the principles and methods of interstage coupling:<br>i. Resistance-capacitive coupling.<br>ii. Direct coupling<br>iii. Transformer coupling.<br>1.6 List the application of the different coupling methods.<br>1.7 Explain with a sketch, the | • Explain the concept of biasing and its effect on transistor operation.<br>• Identify the operation regions on the output characteristics of the transistor.<br>• Draw and explain the operation mechanism of various bias circuits<br>• Explain the effect of load type on the amplifier gain and impedances<br>• Show the effect of decoupling capacitor on the gain of the amplifier.<br>• Discuss the common areas of application of the coupling methods<br>• Explain the different classification of amplifiers and their | Marker, White board, Recommended textbooks, Lecture Notes, Power supplies, transistors (BJT, FET), bias resistors and capacitors), function generator, voltmeter, ammeter, connecting cables. | • Determine by experiments the performance of amplifiers using different biasing methods.<br>• Determine by experiment the gain/frequency curve of a transistor amplifier. | • Guide students through experiments to determine amplifier gain using different bias methods;<br>i. Fixed bias<br>ii. Collector-base bias<br>iii. Potential divider bias.<br>• Estimate the gain of two stage amplifier using<br>• Direct coupling<br>• Capacitive coupling<br>• Transformer coupling | Explain different types of biasing arrangement of transistor amplifier.<br>Fixed bias.<br><br>Collector-base bias without and with a decoupling capacitor.<br>Potential divider bias.<br>Junction FET simple bias. |

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| | frequency response of the coupling methods in 1.5.<br>1.8 Explain the biasing conditions for classes A,B, AB, and C amplifiers.<br>1.9 List the main applications of each type of amplifier in 1.8 above.<br>1.10Explain the operation of simple push-pull amplifier:<br>i. Transformer-coupled.<br>ii. Transformer less coupling. | applications<br>• Estimate the efficiencies of class A, B, AB and C amplifier classes<br>• Give assignments to students on classifications of amplifiers | | | | |
| General Objectives 2 Understand the general principles of feedback and oscillators | | | | | | |
| 4-6 | 2.1 Draw the block diagram of a basic feedback amplifier.<br>2.2 Define positive and negative feedback in amplifiers.<br>2.3 Explain the general expression for stage gain of a basic feedback amplifier.<br>2.4 State the effect of applying negative feedback to an amplifier in relation to:<br>i. Gain.<br>ii. Gain stability.<br>iii. Bandwidth.<br>iv. Distortion.<br>v. Noise.<br>vi. Input and output resistance.<br>2.5 Explain how oscillations can be produced by an amplifier with positive feedback. | • Explain positive and negative feedback in systems<br>• Obtain from the block diagram, how the general expression for feedback is obtained.<br>• State the effect of feedback on gain and stability of a system.<br>• Explain the operation, types and uses of oscillators<br>• Draw and explain the RC phase shift oscillator | Marker, White board, Recommended textbooks, Lecture Notes Power supplies, transistors (BJT, FET), bias resistors and capacitors), function generator, voltmeter, ammeter, connecting cables. | • Determine by experiment the effect of applying negative feedback to an amplifier in relation to the items listed in 2.4 above.<br>• Determine by experiment the operation of:<br>○ R-C oscillator<br>○ L-C oscillator (Hartley<br>○ and coipitts) | Show with experiment that negative feedback results in gain reduction | Explain positive and negative feedback in amplifiers.<br>and the general expression for stage gain of a basic feedback amplifier. |

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| | 2.6 Explain the operation of:<br>i. R- oscillator.<br>ii. L-C oscillator (Hartley &colpitts)<br>2.7 Describe methods of employing frequency stability of oscillators e.g. piezo-electric crystal control etc. | • Draw and explain the Colpitt"s and Hartley oscillator circuits. | | | | Explain methods of employing frequency stability of oscillators. |
| General Objectives 3 Apply the principles of switching circuits | | | | | | |
| 7-10 | 3.1 Explain the characteristics of switch.<br>3.2 Explain with aid of switches the principle of operation of the following multivibrators:<br>i. Bistable.<br>ii. Monostable<br>iii. Astable. | • Draw and explain a simple electronic switch<br>• Draw and explain the operation of the multivibrator circuits.<br>• State the expression for determining the frequencies<br>• Identify new trends in the switching circuits | Marker, White board, Recommended textbooks, Lecture Notes, Power supplies, transistors (BJT, or FET), bias resistors and capacitors), voltmeter, ammeter, Light bulbs, connecting cables. | • Demonstrate the operation of multivibrators<br>o Astable<br>o Monostable<br>o Bistable<br>• Measure the frequency of Astable multivibrator and compare with calculated values. | • Relate the theory with the experiments to be performed<br>• Assign students into groups<br>• Provide practical manuals and reporting guidelines to the students | Explain the principle of operation of multivibrators:<br>. |
| General Objectives 4 Know the action of basic electronic logics gates | | | | | | |
| 11-13 | 4.1 Explain the Boolean functions<br>4.2 Discuss the truth tables<br>4.3 Explain the basic operation of the following electronic logic gates using appropriate symbols and truth tables:<br>i. The „NOT" gateor inventers; | • Define logic gates.<br>• Draw and explain the operation of basic logic gates<br>• Show the states of the gates by means of truth table<br>• Use software packages to show | Marker, White board, Recommended textbooks, Lecture Notes, Power supplies, multimeters, connecting cables. Logic | • Perform logic gate operations using:<br>i. The „NOT" gate or inventers;<br>ii. The „AND" gate;<br>iii. The „OR" gate;<br>iv. The „AND" gate<br>ii. The „NOR" gate | • Ensure students activities are recorded in standard laboratory notebook<br>• Assess the students practical works and add | Explain the basic operation of the The „NOT" gate or inventers;<br>ii. The „AND" |

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| | ii. The „AND" gate;<br>iii. The „OR" gate;<br>iv. The „AND" gate<br>i. The „NOR" gate<br>4.4 Discuss how to configure logic gates<br>4.5 Highlight the applications of logic gates | the logic gates functions and different ways they can be configured | tutor, digital system trainer, logic pulser, logic probe. | | appropriate comments | gate;<br>iii. The „OR" gate;<br>iv. The „AND" gate<br>The „NOR" gate |
| General Objectives 5 Understand the basic circuits used in power supplies | | | | | | |
| | 5.1 Explain with sketches half-wave and full-wave rectification and calculate ripple factors.<br>5.2 Describe with diagrams the operation of a bridge rectifier.<br>5.3 Explain the use of the following as smoothing circuits:<br>i. The capacitor input filter.<br>ii. The inductance input filter.<br>5.4 Explain the action of a stabilized power supply using:<br>i. Zener diode.<br>ii. Series regulator. | • Draw a simple power supply and explain its operation<br>• Explain half wave and full wave rectification.<br>• Compare capacitive and inductive input filters<br>• Discuss the need for power supply regulation. | Marker, White board, Recommended textbooks, Lecture Notes.<br><br>Power supplies, Oscilloscope, capacitors, diodes, transformers, function generator, voltmeter, ammeter, connecting cables. | • Verify the half wave and full wave outputs on the oscilloscope<br>• Verify the effect of filter capacitor on the rectifier output. | • Explain the procedures to be followed to the students<br>• Identify the set of equipment to be used for each experiment<br>• Relate the theory with the experiments to be performed<br>• Assign students into groups<br>• Provide practical manuals and reporting guidelines to the students<br>• | Explain the use capacitor input filter and the inductance input filter. |

Assessment: Give details of assignments to be used: Coursework/Assignments 10%; Course test 10%; Practical 40%; Examination 40%

| Type of Assessment | Purpose and Nature of Assessment | Weighting (%) |
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| Examination | Final Examination (written) to assess knowledge and understanding | 40 |

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| Test | At least 1 progress test for feedback. | 10 |
| Practical / Projects | To be assessed by the teacher | 40 |
| Course work/ assignment | To be assessed by the teacher | 10 |
| Total | | 100 |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING | CODE: CTE 236 | CONTACT HOUR: 60 HRS |
| COURSE: ELECTRONIC /COMPUTER MAINTENANCE AND REPAIRS | Semester:1 | Theoretical:1 \hours/week |
| Year: 1 | Pre-quisite: | Practical:2\hrs |
| Goal: This course is designed to provide the student with practical knowledge and skills in maintenance and repairs of electronic/computer equipment. | | |
| GENERAL OBJECTIVES:<br>On completion of this module, the student should be able to:<br>1. Understand the general use of tools and testing instruments.<br>2. Understand cabling, jointing soldering and de-soldering techniques.<br>3. Know different electronic circuit components<br>4. Use manufactures service manual and circuit wiring diagrams.<br>5. Maintain GSM phones.<br>6. Use of Uninterruptible Power Supply (UPS) and Automatic Voltage Regulators (AVR) | | |

| Time | Theoretical Content | | | Practical Content | | |
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| General Objectives 1 understand the general use of tools and testing instruments | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1-2 | 1.1 Identify the following test instruments:.<br>i. Multi-tester;<br>ii. Transistor tester;<br>iii. Oscilloscope;<br>iv. Electronic voltmeter instruments.<br>1.2 Explain the uses of the items in 1.1 above | • List, sketch and state the applications of each test instrument in 1.1<br>• Discuss with the students in more details the use items in 1.1. | • Textbooks<br>• Instrument catalogs<br>• Instrument user manuals.<br>• Multi-tester;<br>• Transistor tester;<br>• Oscilloscope;<br>• Electronic voltmeter instruments.<br>• Practical manuals | • Carry out identification of items in 1.1<br>• Show competence in the use of items in 1.1 | • Teacher demonstrates the use of items in 1.1<br>• Ask students to identify and demonstrate the use of items in 1.1 | Explain the use of Multi-tester; Transistor tester Oscilloscope and Electronic voltmeter instruments |
| General Objectives 2 Understand cabling jointing soldering and de-soldering techniques | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 3-6 | 2.1 Explain the types of cables used in;<br>i) Power supply<br>ii) Communication between systems.<br>iii) Communication between systems and | • Describe cables, discuss in details the what is meant by the term cabling as well as steps for cabling<br>• Discuss | • Textbooks<br>• Journals<br>• Soldering iron<br>• Lead<br>• Lead sucker<br>• Cutter<br>• Vero boards<br>• components required for selected circuits | • Perform the procedure and techniques in 2.3 and 2.3.<br>• Wire up and solder component to make simple electronic circuits.<br>• Carry out de-soldering<br>• Carry out each | • Demonstrate the procedure and techniques in 2.2 and 2.3.<br>• Ask students to demonstrate the | 1Explain the types of cables used in;<br>-Power supply<br>Communication between systems.<br>Communication between systems and peripherals.<br>• |

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| | peripherals.<br>2.2 Outline cabling procedure and practice.<br>2.3 Explain the types of cables, choice and methods of testing, as well as the instruments used for testing:<br>i) Twisted pair cables<br>ii) Coaxial cables RS-232 standard communication cables<br>2.4 Explain the following:<br>a. Jointing techniques;<br>b.Soldering and disoldering techniques;<br>c. Crimping and fastening method. | with illustration details of items in 2.2, 2.3 and 2.4 | • RJ45connector<br>• Crimping tools<br>• Communication cables<br>• Practical manuals | techniques in 2.4 | procedure and techniques in 2.2 and 2.3<br>• Guide students to carry out the procedure and techniques in 2.4 | |
| General Objectives 3 Know different circuit components | | | | | | |
| Week | Specific Learning Outcomes | Teacher's Activities | Learning Resources | Specific Learning Outcomes | Teacher's Activities | Evaluation |
| 7-8 | 3.1 Identify values of resistors and capacitors using colour codes.<br>3.2 List different | • Explain how to determine values of resistors | • Textbooks<br>• Assorted Resistors<br>• Assorted Capacitors | • Determine the values of resistors and capacitors using colour codes. | • Ask students to determine the values | • What is the uses of resistors and capacitors using colour codes<br>Explain the value of |

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| | types of resistors (carbon, wire-wound, ketal oxide etc. and capacitors.<br>3.3 Identify the following electronic components;<br>i. Transistors;<br>ii. Diodes;<br>iii. Integrated circuit (IC"s);<br>iv. Resistors by their preferred values and power rating.<br>v. Capacitors by their working voltage and types.<br>3.4 Explain open-circuit and short-circuit defects in components listed in 3.3.<br>3.5 Outline various methods of testing components:<br>a. In-circuit.<br>b. Out of circuit. | and capacitors using colour codes.<br>• List different types of resistors and capacitors in 3.2<br>• Using catalog, explain the various available preferred values of items in 3.3 | • Assorted Transistors<br>• Assorted diodes<br>• Assorted logic ICs<br>• Digital multimeters<br>• Practical manuals | • Carry out test for each component in 3.3 using techniques in 3.5 | of resistors and capacitors using colour codes.<br>• Demonstrate and carry out test for each component in 3.3 using techniques in 3.5 | the following electronic components;<br>i. Transistors;<br>ii. Diodes;<br>i. Integrated circuit (IC"s);<br>ii. Resistors by their preferred values and power rating.<br>iii. Capacitors by their working voltage and types. |
| General Objectives 4 Understand the use of manufactures service manual and circuit wiring diagrams | | | | | | |
| Wee | Specific Learning | Teacher"s | Learning Resources | Specific Learning | Teacher"s | Evaluation |

| k | Outcomes | Activities | | Outcomes | Activities | |
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| 9-11 | 4.1 Discuss circuit tracing.<br>4.2 Outline trouble shooting and fault isolating techniques.<br>4.3 List observation test method:<br>i. Visual;<br>ii. Touch;<br>iii. Smell;<br>iv. Hearing.<br>4.4 Explain D.C and A.C signal testing.<br>4.6 Explain stage or module by substitution. | • List, explain observation test methods listed in 4.1 | • Textbooks,<br>• manufactures service,<br>• manual and circuit wiring diagrams.<br>• manufactures service manual<br>• circuit wiring diagrams<br>• logic probe<br>• oscilloscope<br>• Digital multimeters<br>• Replaceable modules<br>• Practical manuals | • Carry out fault tracing by observation methods<br>• Perform test to identify faulty components by measurement (voltage and resistance test).<br>• Replace faulty components. | • Demonstrate and instruct students to carry out fault tracing by observation methods<br>• Demonstrate and guide students to identify faulty module by measurement (voltage and resistance test). | • List types of trouble shooting and fault isolating techniques and observation test method |
| General Objectives 5 Know the maintenance of GSM phones | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| | 5.1 Identify various mobile phone (GSM) accessories and their function<br>5.2 Explain the various mobile phone (GSM) accessories and | • Describe the function and use of hands free/headset, earpiece, external Bluetooth, chargers, batteries, | • Textbooks,<br>• Catalogs<br>• Phone manuals<br>• Good and Scrap mobile phones<br>• Workstation<br>• Data cable<br>• Phone manuals<br>• Precision set | • Perform the following on GSM phones:<br>- Troubleshooting,<br>- Dismantling,<br>- Assemble and<br>- Test<br>• Perform fault | • Demonstrate and guide students to solve common hardware problems stated in | • Describe common GSM hardware problems related to mouthpiece, earpiece, charging port, keyboard and damage screen, vibrator.<br>• Describe common |

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| | their functions<br>5.3 Identify common GSM hardware problems related to mouthpiece, earpiece, charging port, keyboard and damage screen, vibrator, etc<br>5.4 Identify common GSM software problems such as SIM rejection, phone lock, invalid SIM , hanging, restarting etc. | etc,<br>• List and describe common GSM hardware problems listed in 5.2<br>• List and describe common GSM software problems listd in 5.3 | • Allen key set<br>• Magnifying desk lamp<br>• Service provider chart codes<br>• Ultrasonic cleaner<br>• Flashing and unlocking devices/computer softwares<br>• Practical manuals | finding using software. | 5.2<br>• Demonstrate and guide students to resolve common hardware problems stated in 5.3 | GSM software problems such as SIM rejection, phone lock, invalid SIM , hanging, |
| General Objectives 6 Understand the use of Uninterruptible Power supply (UPS) and Automatic voltage regulators (AVR) | | | | | | |
| | Week | Specific Learning Outcomes | Teacher"s Activities | Learning Resources | Specific Learning Outcomes | Evaluation |
| 14-15 | 6.1 Briefly explain the operation of a UPS and AVR for steady power supply in computer system.<br>6.2 Explain the process of cooling and the essence of having good ventilation and cooling systems. | • Explain the applications of UPS with emphasizes on battery usages, charging, and effect of UPS over loading<br>• Describe different methods of cooling and | • Textbooks<br>• UPS<br>• AVR<br>• Good and bad UPS batteries<br>• Good and open circuited power cords<br>• Practical manuals/guide | • Demonstrate faults diagnoses in UPS and AVR | • Demonstrate the common faults in UPS such as bad battery, power cord open circuit, etc | What is the process of cooling and what is the essence of having good ventilation and cooling systems. |

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| | 6.3 Explain maintenance of batteries and battery chargers | ventilation in computer power system | | | | |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 232 | CREDIT HRS: 45 HRS<br>(0/3/0/WEEK) |
| COURSE: COMPUTER WORKSHOP PRACTICE I | COURSES UNIT 1.0 | |
| | | |
| Goal: The course is designed to enable students have the knowledge of the various components, assembling and installation of the computer system. | | |
| GENERAL OBJECTIVES:<br>On completion of this module, the student should be able to:<br>1.0 Know the various components of the computer system.<br>2.0 Use of installation/maintenance manual.<br>3.0 Know preventive and maintenance of computer system<br>4.0 Know the how to assemble and install a computer system | | |

| | Theoretical Content | | | | | |
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| General Objectives 1 Know the various components of the computer system | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s activities | Evaluation |
| 1 - 4 | 1.1 Identify the system unit, monitor, mouse, scanner, printer, plotter etc.<br>1.2 Identify the various components of the system unit such as:<br>✓ Motherboards<br>✓ CPU<br>✓ CPU overdrive<br>✓ Controller card<br>✓ VGA card<br>✓ Expansion slots (8,16,32,64 bits)<br>1.3 Identify the hard disk types EIDE, IDE, SCSI etc.<br>1.4 Identify the memory types on the board/card: Cache, VRAM, SRAM, DRAM etc. | Show the students hard disk drive types.<br>EIDE, IDE, SCSI, etc.<br>Show the student the types of computer memory | System unit<br>Lab coat<br>White board<br>Marker | | | identify system unit and other I/O devices |

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| | 1.5 Identify the floppy disk drives $3^{1/2}$ / $5^{1/4}$ disk drives. | on the board/card.<br><br>Show the students types of floppy drives. | | | | |
| General Objectives 2 The use of installation/Maintenance Manual | | | | | | |
| 5-8 | 2.1 Interpret the installation/maintenance manuals.<br><br>2.2 Carry out RAM upgrade.<br><br>2.3 Explain site preparation method.<br><br>2.4 Explain the need for<br><br>equipment inventory.<br><br>2.5 Carry out the pre-installation checks of a computer i.e. electrical, mechanical, humidity etc.<br><br>2.6 Carry out simple computer | Introduce the students to installation and maintenance of computer system.<br><br>Introduce the students to installation and | White board<br>Marker<br>Textbooks<br><br>UPS<br><br>AVR<br><br>Good and bad computer system.<br><br>Good and open circuited power cords<br><br>Practical manuals/guide | Demonstrate simple computer installation | Guide students in the demonstrate simple computer installation | Carry-out simple installation and maintenance of the computer. |

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| | installation. | maintenance of computer system | | | | |
| General Objectives 3 Know preventive maintenance | | | | | | |
| 9-11 | 3.1 Explain the importance of preventive maintenance of hardware.<br>3.2 Carry out routine cleaning and demagnetization of disk drives, motherboards etc.<br>3.3 Demonstrate prevention procedures e.g. routine checks.<br>3.4 Apply dust prevention procedure for Computer systems, Carpets etc.<br>3.5 Know how to make system disks with utilities. | Explain the importance of maintenance of hardware. | White board<br>Marker<br>Textbooks<br>UPS<br>AVR<br>Good and bad computer system.<br>Good and open circuited power cords<br>Practical manuals/guide | Demonstrate routine cleaning and demagnetization of disk drives, motherboards, etc. | Guide to demonstrate routine cleaning and demagnetization of disk drives, motherboards, etc. | Maintenance tools, such as screwdriver, brush, methylated spirit, etc. |
| General Objectives 4 Assemble and install a computer system | | | | | | |
| 12-15 | 4.1 Assemble a computer system.<br>4.2 Install a computer system.<br>4.3 Configure of a | Explain the process of assembling a computer system.<br>Installation of a computer system | Hardware components, such as drives, motherboards, | Assemble a computer system.<br>Install a computer system.<br>Configure of a computer | Guide students in the: Assembling of a computer system.<br>Installation of a | Assemble, install and configure a computer systems. |

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| | computer system. | and Configuration of a computer system | etc Monitor | system | computer system. Configuration of a computer system | |

| General Objectives 4 Assemble and install a computer system | | | | | | |
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| 12-15 | 4.4 Assemble a computer system.<br>4.5 Installation and configuration of a computer system. | | Hardware components, such as drives, motherboards, etc Monitor | | Demonstrate computer system assembling | . |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 215 | CREDIT HRS: 75 HRS<br>15 WEEK |
| COURSE: DIGITAL FUNDAMENTAL II | COURSES UNIT 4.0 | |
| Semester 3 | | |

Goal: This course is intended to provide the student with the knowledge of the principles of bistable or flip-flop in the operations and applications of logic devices.

GENERAL OBJECTIVES:

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

1. Understand the features of different logic gates and the sequence and data flow controls
2. Understand basic principle of bistable elements and the principle of counter and register
3. Know the implementation of the addition operation in the computer and digital circuit components.
4. Understand the characteristic of basic digital devices and the design and construction of simple combinational logic circuits using the basic devices.
5. Understand the operation of bistable elements and simple sequential circuit.

| Programme: National Diploma in Computer Engineering | | | | Course code: CTE 215 | | Contact Hours: |
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| Course: Digital Fundamental II | | | | | | Theoretical: 2 |
| Year: Two Semester: Three | | | | Pre-requisite: None | | Practical: 2 |
| General Objective 1.0 (CTE 215): Understand the features of different logic gates and the sequence and data flow controls | | | | | | |
| Week | Theoretical Content | | | Practical Content | | |
| | Specific Learning Objectives | Teacher"s activities | Resources | Specific Learning Objectives | Teacher"s activities | Evaluation |
| 1-4 | 1.1 Explain the principle of operation of combinational logic..<br>1.2 Illustrate the action of gates using truth-table.<br>1.3 Write down a logical sum of product equations.<br>1.4 Draw circuit diagram that implements the equation above. Using : AND,OR,NOT gates.i) NAND ii) NOR iii) Exclusive-OR iv) Exclusive-NOR functions.<br>1.5 Design logic | • Give the<br>• format of all the<br>statements.<br>• Write<br>• sample program<br>containing all the<br>statements<br>• Write<br>• sample format statement.<br>Illustrate different logic families.<br>• list ICs | PC<br>Loaded with<br>Instructional manual, Compiler,<br>Power point<br>package and<br>connected to an OHP.<br>PC<br>Loaded with<br>Lecture | write simple logical statement using<br>DO-WHILE and NEXT -<br>LOOP statement.<br>To be able to detect error in logical expression. | Assist student to write and<br>run simple java program<br>using DO-WHILE and NEXT<br>-LOOP statement.<br>write<br>Error free arithmetic expression for string<br>nanipulation | Explain the principle of operation of combinational logic. |

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| | circuits using a combination of logic gates.<br>1.6 Describe the action of the Diode.<br>1.7 Describe the construction of the AND, or OR gates using diode.<br>1.8 Explain error detection<br>1.9 Explain the features and attributes of the different logic families.<br>1.10 Explain the characteristics and circuit parameter of logic families e.g i) fan-in / fan-out ii) speed/power factor logic levels iii)noise immunity iv) heat dissipation. | characteristics.<br>• sample programs to teach<br>parameter passing<br>mechanism. | manual,<br>Compiler,<br>Power point<br>package and<br>connected to an<br>OHP | | | |
| General Objectives 2 Understand basic principle of bistable elements and the principle of counter and register | | | | | | |
| | 2.1 Define a bistable (flip flop).<br>2.2 Describe the action of a flip flop.<br>2.3 Describe the | • Give the general format of<br>Flip-flop.<br>• identify different | PC<br>Loaded with lecture materials | | | Explain the operation i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip- |

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| | operation of the following bistables elements: i) RS Flip-flop ii) Clocked RS flip-flop iii) D-flip-flop,T-flip-flop(toggle flip-flop),JK-flip-flop.<br>2.4 Explain the function of preset and clear of the bistable element.<br>2.5 Describe some specific I.C bistable elements e.g i) SN 7474 ii) SN 7476.<br>2.6 Describe the operation of the basic binary ripple counter.<br>2.7 Describe the operation of up and down counters<br>2.8 Describe the operation of the modules counter using as example Mod-10, Mod-12, and Mod-6 counters.<br>2.9 Define a shift-left, a shift-right and | types of bistable elements.<br>• Show the operation of different modules e.g mod-6,mod10 and mod-12.<br>• Describe how data can be transfer serially and in parallel means.<br>. | Power point<br>package and<br>connected to an OHP.<br>PC in a networked<br>laboratory<br>Loaded with<br>Compiler,<br>and Power point<br>package and<br>connected to<br>Internet | | | flop(toggle flip-flop),JK-flip-flop. |

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| | shift round registers.<br>2.10 Describe the parallel transfer of data through registers.<br>2.11 Describe the serial-parallel transfer operation. | | | | | Explain the parallel transfer of data through registers. and the serial-parallel transfer operation. |
| General Objectives 3 Know the implementation of the addition operation in the computer and logical circuit components | | | | | | |
| 9-11 | 3.1 Describe the serial adder<br>3.2 Describe the parallel adder<br>3.3 Describe the half-adder<br>3.4 Describe the full-adder<br>3.5 Describe different logic element<br>3.6 Identify AND,OR,NOT,NAND and XOR gates | • -Illustrate events driven<br>Counters and registers with examples.<br>• -Ask students to draw the<br>Examples of adders.<br>• -Give programming<br>exercise on event driven<br>programs. | PC<br>Loaded with<br>Lecture materials,<br>Power point<br>package and<br>connected to an OHP | Connect a simple<br>Logical circuit.<br>To be able to identify different logic gates. | write a<br>simple java event driven<br>program | Describe the serial adder, parallel adder half-adder and the full-adder |
| General Objectives 4 Understand the characteristic of basic digital devices and the design and construction of simple combinational logic circuits | | | | | | |

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| using | | | | | | |
| | Be able to:<br><br>4.1 Describe the operation of different logic elements e.g AND, OR,NOT,NOR,NAND, and XOR gates.<br>4.2 Draw the circuit diagram that implement various circuit combinations. | • Show the students different types of logic gates.<br><br>• Draw their circuit diagram.<br><br>•<br><br>• assignment to cover topics.<br><br>• Questions and Answer<br><br>• sessions. | PC Loaded with Lecture materials Power point package and connected to an OHP PC in a networked laboratory Loaded with, and Power point package and connected to Internet | Demonstrate practically the logic AND,OR,NOT using i) Logic gates ii) Discrete elements.<br><br>Demonstrate practically the logic AND,OR,NOT using i) Logic gates ii) Discrete elements.<br><br>Demonstrate practically the operation of combinational logic function | Guide the students on how to carry out the practicals in the Learning Outcome for practical. | Draw the circuit diagram that implement various circuit combinations |
| General Objectives 5 Understand the operation of bistable elements and simple sequential circuit | | | | | | |
| | 5.1 Draw some specific IC bistable elements e.g SN 7474, SN 7476.<br>5.2 Construct the elements in above.<br>5.3 Analyse the design techniques of sequential circuits.<br>5.4 Perform experiments to | • show the students different types of ICs.<br><br>• show them SN 7474 series and<br><br>7476 series of ICs.<br><br>•<br><br>• assignment to cover topics. | PC Loaded with Lecture materials Power point package and connected to an OHP PC in a networked laboratory | Perform experiments to illustrate sequential circuit (counters,registers) using the various bistable elements | • show the students different types of ICs.<br><br>• show them SN 7474 series and<br><br>7476 series of ICs.<br><br>•<br><br>• assignment to cover topics. | Illustrate some specific IC bistable elements e.g SN 7474, SN 7476. |

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| | illustrate sequential circuit (counters,registers ) using the various bistable elements. | • Questions and Answer<br>• sessions. | and Power point package and connected to Internet | | • Questions and Answer<br>• sessions - | |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 214 | CREDIT HRS: 2 HRS (0/2/0/WEEK) |
| COURSE: COMPUTER ARCHITECTURE | UNIT: 2.0 | |
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| GOAL: This course is intended to provide the students with basic knowledge and skills of the structural and functional characteristics of various components of computer system. | | |
| GENERAL OBJECTIVES: On completion of this course, student should be able to:<br>1.0 Know the basic concept of computer architecture<br>2.0 Understand concept of memory organization of computer system<br>3.0 Appreciate the conventional 8/16/32-bit computer architecture<br>4.0 Know the addressing modes<br>5.0 Know interrupts and their various types | | |

| Programme: National Diploma in Computer Engineering | | | | Course code: CTE 214 | | Contact hr.2 |
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| Course: COMPUTER ARCHITECTURE | | | | | | |
| Year : two | Semester 3 | | Pre-requisite | | Theoretical 2 | |
| | | | | | Practical 0 | |
| Goal: | | | | | | |
| Theoretical Content | | | | Practical Content | | |
| General Objectives 1 Know the basic concept of computer architecture | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| | 1.1 Describe the various word formats.<br>1.2 Explain the concept of Von Neumman"s Structure.<br>1.3 Explain various units and registers of a typical CPU.<br>1.4 Explain the various methods of addressing software and hardware components. | Explain the various word formats<br><br>Explain in details Von-Neumman's architecture and futures.<br><br>Explain in details item 1.3 to1.4 | Lecture note, White board, Power Point Presentation | | | Explain the various methods of addressing software and hardware components |
| General Objective 2: Understand concept of memory organization of computer system | | | | | | |
| | 2.1 Explain microcomputer control Bus, Address Bus and Data Bus.<br>2.2 Explain the use of memory management and mention techniques commonly used.<br>2.3 Explain the concept of cache memory. | Explain data, control and address buses.<br><br>Explain what is memory management and its techniques | Lecture note, White board, Power Point Presentation | | | Explain the use of memory management and mention techniques commonly used |
| General Objective 3: Appreciate the conventional 8/16/32-bit computer architecture | | | | | | |
| 3-4 | 3.1 Explain conventional 8/16/32 bit computer architecture.<br>3.2 Define the concept of pipeline instruction sets, | Explain and demonstrate the concept of inner and outer buses as well as downgraded | Lecture note, White board, Power Point Presentation | | | |

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| | reduced instruction.<br>3.3 List microprocessor CPU of 8/16/32 bit architecture. | version of computer architecture.<br><br>Explain some computer instruction sets.<br><br>Explain various types of microprocessors and its block diagram presentation. | | | | |
| General Objective 4: Know the addressing modes | | | | | | |
| | 4.1 Explain instruction components opcode and operand.<br>4.2 Explain operand types- Register, Memory, and immediate.<br>4.3 Explain instruction Fetch and Execute.<br>4.4 Explain addressing modes- Direct, indirect, immediate and indexing. | Explain in details components of 4.1 to 4.4.<br><br>Demonstrate their types using power point presentation. | Lecture note, White board, Power Point Presentation | | | Explain instruction components opcode and operand.<br>Register, Memory, and immediate.<br>Instruction Fetch and Execute. |
| General Objective 5: Know interrupts and their various types | | | | | | |
| | 5.1 Define interrupt and Enumerate types.<br>5.2 Explain Branching techniques. | Explain in details various types of interrupt.<br><br>Explain the branching techniques, direct and indirect. | Lecture note, White board, Power Point Presentation | | | Enumerate types of interrupt. |

Assessment: 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: NATIONAL DIPLOMA IN COMPUTER ENGINEERING | CODE: EEC 235 | CREDIT HRS: 60 HRS |
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| COURSE: ELECTRICAL MEASUREMENT & INSTRUMENTATION II | COURSES UNIT 2.0 | |
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Goal: This course is intended to enable the student select, connect and use electronic/electrical instruments for measurement of physical quantities.

GENERAL OBJECTIVES:

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

7. Use of different types of meters for measuring power and power factor.
8. Use of different types of bridges (a.c. and d.c.).
9. Understand the principle of operation of a fluxmeter and its application.
10. Understand the principle and use of digital instruments.
11. Know the various factors which should be considered when selecting an instrument.
12. Understand the main types of measurements and measuring instruments.

| Theoretical Content | | | | | | |
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| General Objectives 1 Use of different types of meters for measuring power and power factor | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1 – 3 | 1.7 Explain the electrodynamics principles of different types of power measurement.<br>1.8 Describe the operation of electrodynamics wattmeter and power factor meter.<br>1.9 Explain the induction principle of power measurement.<br>1.10 Describe the induction wattmeter.<br>1.11 Describe the use of two wattmeter for power measurement in a 3 phase circuit.<br>1.12 Measure Power in:<br>b. Single phase circuit;<br>c. 3 phase circuit, using wattmeter and p.f. meters | - Explain the circuit structure of wattmeter and power factor meter<br><br>Explain the circuit for power measurement using wattmeter and power factor meter | Chalk, Board, recommended textbook,.<br><br>Power supplies, Wattmeter and power factor meter | Use wattmeter to measure power in ac and dc circuits. | - Demonstrate the use of wattmeter for power measurement in single phase circuit.<br>- Demonstrate the use of two wattmeters for power measurement in 3-phase circuits | Describe the induction wattmeter and the induction principle of power measurement. |
| General Objectives 2 Use of different types of bridges (A.C and D.C) | | | | | | |
| 4 – 6 | 2.1 Explain the term null indicator.<br>2.2 Describe the expression for the measurement of an | - Explain the types and uses of various electrical bridge; | Chalk, Board, recommended textbook. | Practice the use of bridges for accurate measurements | - Demonstrate the use of dc and ac bridges to measure<br>- resistance<br>- capacitance | Measure circuit parameters using electrical bridges. |

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| | unknown resistance by Wheatstone bridge circuit.<br>2.3 Derive the expression for the measurement of an unknown resistance by Wheatstone bridge circuit.<br>2.4 Describe the Carey Foster"s slide wire bridge.<br>2.5 Explain the structure of the following ac bridges<br>Wien bridge<br>Maxwell"s bridge<br>Schering bridge<br>Hay bridges bridge<br>2.6 Derive expressions for the measurement of unknown capacitance or inductance using the bridges in 2.5 above.<br>2.7 Explain, how a.c. bridge can be used to measure;<br>i. Resistance;<br>ii. Inductance;<br>ii. Capacitance;<br>iv. Frequency<br>2.8 Measure the items listed in 2.5 above. | | Power supplies, Wattmeter and power factor meter | | - inductance<br>- frequency<br><br>- Give the students experiments to measure the above basic circuit parameters | Explain the structure of ac bridges,<br>Wien bridge<br>Maxwell"s bridge,<br>Schering bridge<br>Hay bridges bridge.<br><br>Explain, how a.c. bridge can be used to measure;<br>i. Resistance;<br>ii. Inductance;<br>iii. Capacitance;<br>iv. Frequency |
| General Objectives 3 Understand the principle of operation of a fluxmeter and its application | | | | | | |
| | 3.1 Describe the | Explain the | Chalk, | | - Draw the B-H | |

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| 7 – 8 | constructional features of a fluxmeter.<br>3.2 Explain the principle of operation of a fluxmeter.<br>3.3 Explain the use of a fluxmeter for drawing B H curves.<br>3.4 Determine by experiments the B.H curves for different magnetic materials using a flux meter. | importance of B-H curves for magnetic materials | Board, recommended textbook. | | curves for magnetic materials using values measured with flux meter | Explain the principle of operation of a fluxmeter |
| General Objectives 4 Understand the principle and use of digital instruments | | | | | | |
| 9 – 10 | 4.1 Explain with aid of block diagram the working principles of a digital voltmeter and ammeter.<br>4.2 Explain how the DVM can be used to measure:<br>a. Voltage;<br>b. Current;<br>c. Resistance.<br>4.3 State the limitations of the DVM for measuring high frequency signals.<br>4.4 Explain with aid of a block diagram, the working principle of a digital frequency meter.<br>4.5 State advantages of | - Give the essential features of digital instruments.<br>- Emphasize the advantages and limitations of digital instruments compared to analogue instruments<br><br>Explain the advantages of digital meters and electromechanical measuring instruments | Chalk, Chalkboard, Notes, recommended textbook. | Demonstrate how to measure voltage, current using digital instruments | Guide students to Demonstrate how to measure voltage, current using digital instruments | Use measuring instrument to measure voltage, current, frequency and resistance.<br><br>Explain with aid of a block diagram, the working principle of a digital frequency meter. |

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| | digital meters over other electromechanical measuring instruments.<br>4.6 Measure Voltage, current and frequency using digital instruments. | | | | | |
| General Objectives 5 Know the various factors which should be considered when selecting an instrument | | | | | | |
| 11 – 12 | 5.1 Explain the importance of the factors using the following factors in selecting instruments for measurement<br>i. Range.<br>ii. Accuracy.<br>iii. Response.<br>iv. Input.<br>v. Stability.<br>vi. Operation.<br>vii. Reliability.<br>viii. Sensitivity. | Explain the effect of various instruments parameters on the measurand | - Ditto - | | | Explain the<br>i. Range.<br>ii. Accuracy.<br>iii. Response.<br>iv. Input.<br>v. Stability.<br>vi. Operation.<br>vii. Reliability.<br>Sensitivity |
| General Objectives 6 Understand the main types of measurements and measuring instruments | | | | | | |
| 13 – 15 | 12.1 Explain instrumentation and its importance.<br>12.2 Explain the working principles and uses of the following instruments:<br>g. Indicating instrument;<br>h. Recording | Explain instrument classifications.<br><br>Explain the working principles and uses of measuring instruments | - Ditto - | | | |

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| | instrument;<br>i. Controlling instruments<br>12.3 Differentiate the instruments stated in 6.2 above, giving example of each.<br>12.4 Calibrate each types of instrument in 6.2 | | | | | |

FORTH SEMESTER

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING | CODE: CTE 246 | CREDIT HRS: 30 HRS |
| COURSE: ELECTRICAL CIRCUIT THEORY II | COURSES UNIT 2.0 | |
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Goal: This course is designed to enable the student acquire further knowledge in electric and magnetic circuit analysis.

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

1. Understand the principles of power calculation in a.c. circuits.
2. Know simple integrated circuit (IC) and its ratings.
3. Understand time domain analysis of RC, RL and RLC circuits.
4. Understand the magnetic coupling phenomena.

| Theoretical Content | | | | | | |
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| General Objectives 1 understand the principles of power calculation in A.C. circuits | | | | | | |
| Week | Specific Learning Outcomes | Teacher"s Activities | Resources | Specific Learning Outcomes | Teacher"s Activities | Evaluation |
| 1 – 3 | 1.1 Calculate power in A.C. circuits containing:<br>a. Resistance;<br>b. Inductance;<br>c. Capacitance;<br>d. Combinations of (i.) - (iii)<br>1.2 Explain power factor and factors affecting its value<br>1.3 Explain the following:<br>a. Apparent power;<br>b. Reactive power;<br>c. Active power.<br>1.4 Explain methods of power factor correction<br>1.5 Solve problems on power factor, active power, apparent power, reactive power and power factor correction. | Show how to calculate<br>a. Power from a.c. circuit<br>b. Explain various ways to get a.c. parameters.<br>c. Discuss the use of 3-phase a.c. power.<br>d. Show how to calculate various parameters in frequency domain.<br>e. Explain coupling. | Whiteboard;<br>Marker;<br>Overhead Projector;<br>Recommended Books; | | | Explain the following:<br>a. Apparent power;<br>b. Reactive power;<br>c. Active power. |
| General Objectives 2 Know simple integrated circuit (IC) and its ratings. | | | | | | |
| 4 - 7 | 2.1 Define integrated circuit (IC).<br>2.2 List types of ICs.<br>2.3 Explain features of 2.2.<br>2.4 Explain the following types of ratings:<br>a. Noise;<br>b. Propagation delay;<br>c. Fan in and Fan out;<br>d. Power dissipation;<br>e. Packaging density;<br>f. Clock frequency. | • Explain variety of ICs.<br>• Explain applications of IC.<br>• Describe small, medium, large scales etc integrations in ICs.<br>• Explain surface mount, through | Whiteboard;<br>Marker;<br>Overhead Projector;<br>Recommended Books; | | | Explain the following types of ratings:<br>a. Noise;<br>b. Propagation delay;<br>c. Fan in and Fan out;<br>d. Power dissipation;<br>e. Packaging density;<br>Clock frequency |

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| | 2.5 Explain the levels of IC integration.<br>2.6 Explain SSI, MSI, LSI, VLSI and ULSI.<br>2.7 Explain simple IC packaging. | hole etc IC packaging. | | | | |
| General Objectives 3: Understand time domain analysis of RC, RL and RLC circuits | | | | | | |
| 8 - 11 | 3.1 Explain the meaning of transients<br>3.2 Sketch the growth and decay curves in RC circuits<br>3.3 Derive formulae for current & voltage growths and decay in RC circuits.<br>3.4 Define time constant<br>3.5 Explain time constant in RC and circuits<br>3.6 Derive expressions for the growth and decay of voltage and current in RL circuits.<br>3.7 Sketch curves for growth and decay of current and voltage in RL circuits.<br>3.8 Explain the need for connecting a resistor in parallel with an inductor<br>3.9 Derive expressions for growth and decay of current in RLC circuits.<br>3.10 Derive expressions for the time constant and natural frequency for RLC circuits.<br>3.11 Solve problems involving transients in RC., RL and RLC circuits. | • Teacher should illustrate domain analysis of RC, RL, RLC circuit with appropriate diagrams and models | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | Derive expressions for the growth and decay of voltage and current in RC, RL and RLC circuits. |

| General Objectives 4 Understand the magnetic coupling phenomena | | | | | | |
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| 12 - 15 | 4.1 Describe magnetic coupling.<br>4.2 Define mutual inductance.<br>4.3 Determine the polarity of coupled coils.<br>4.4 Define coefficient of coupling.<br>4.5 Define an equivalent circuit for magnetically coupled coils.<br>4.6 Define an ideal transformer.<br>4.7 Use 4.5 to derive an equivalent circuit of an ideal transformer.<br>4.8 Explain with the aid of sketches, an equivalent circuit of a practical transformer.<br>4.9 State applications of magnetic couplings. | • Explain the applications of magnetic couplings in electronic and computer devices. | Whiteboard; Marker; Overhead Projector; Recommended Books; | | | Define mutual inductance, coefficient of coupling. an equivalent circuit for magnetically coupled coils and an ideal transformer. |

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| PROGRAMME: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 222 | CREDIT HRS: 75 HRS<br>15 WEEK |
| COURSE: TELECOMMUNICATION ENGINEERING I | COURSES UNIT 4.0 | |
| Semester 4 | | |

Goal: This course is designed to enable student acquire basic knowledge and skills in Telecommunication

Engineering.

GENERAL OBJECTIVES:

On completion of this module, the student 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
5. Know various frequency bands within the radio spectrum
6. Understand the principles of electromagnetic wave radiation
7. Understand the principles of radio wave propagation
8. Analyze the characteristics of simple telecommunication circuits

| Programme: National Diploma in Computer Engineering | | | Course code: CTE 222 | | Contact Hours: | |
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| Course: Telecommunication Engineering I | | | | | Theoretical: 2 | |
| Year: Two Semester: Four | | | Pre-requisite: | | Practical: 2 | |
| General Objective: 1.0 Understand the basic principles of telecommunication system | | | | | | |
| Week | Theoretical Content | | | Practical Content | | |
| | Specific Learning Objectives | Teacher"s activities | Resources | Specific Learning Objectives | Teacher"s activities | Evaluation |
| 1 | 1.1 Draw the block diagram of a simple communication system showing:-<br>a. Input transducer;<br>b. Transmitter;<br>c. Transmission channel;<br>d. Receivers;<br>e. Output transducer.<br>1.2 Explain the function of the blocks listed in 1.1 above.<br>1.3 Define energy and describe forms of energy<br>1.4 Properties of energy or waves<br>1.5 Characteristics of Mechanical and Electrical energy | Draw a typical Telecommunication system and explain how it works.<br><br>Explain how a signal is generated from the transducer.<br><br>List various types of transducer that can be used for telecommunications.<br><br>Explain the need for modulation. | • Students to visit Broadcasting Station transmitter station & Exchange, textbooks, | | | Illustrate<br>a.Input transducer;<br>b. Transmitter;<br>c. Transmission channel;<br>d. Receivers;<br>e. Output transducer |

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| General Objectives 2 Understand the principles of operation and application of various transducers | | | | | | |
| | 2.1 Describe sound transducers;<br>a. Microphones<br>b. loud speakers<br>2.2 Explain, with the aid of diagrams, the principles of operation and uses of:<br>a. Carbon microphone;<br>b. Crystal microphone;<br>c. Moving coil loudspeaker;<br>d. Moving iron telephone receiver<br>e. Capacitor microphone | • Explain the uses and operations of transducers | broadcasting stations, textbooks | visit broadcasting stations, textbooks | Guide students in a to visit to broadcasting stations, textbooks | Explain, with the aid of diagrams, the principles of operation and uses of:<br>a. Carbon microphone;<br>b. Crystal microphone;<br>c. Moving coil loudspeaker;<br>d. Moving iron telephone receiver<br>e. Capacitor microphone |
| General Objectives 3 Understand the basic principles of modulation and demodulation | | | | | | |
| | 3.1 Explain the significance of modulation and demodulation in communication systems.<br>3.2 Explain the following | Explain the applications of Modulation and demodulation to Communication systems | Frequency deviation with FM Modulated signal | Perform experiment on amplitude Modulation with signals in audio Frequency band<br>Perform experiment on | Perform experiment on amplitude Modulation with signals in audio Frequency band<br>Perform experiment on | Explain the significance of modulation and demodulation in communication systems. |

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| | modulation processes:-<br>a. Amplitude modulation;<br>b. Frequency modulation.<br>3.3 Explain the following regarding amplitude modulation:<br>a. side frequencies;<br>b. side band;<br>c. modulation index;<br>d. modulation envelope;<br>e. bandwidth.<br>3.4 Solve problems involving the following:<br>a. Modulation index;<br>b. Bandwidth.<br>3.5<br>.<br>3.6 Explain why F.M. has a wider Bandwidth than A.M.<br>3.7 Compare the parameters of F.M. with A.M.<br>3.8 Solve | | | Perform experiment on amplitude Demodulation with AM modulated signal<br>Perform experiment to determine the frequency deviation with FM modulated signal | amplitude Demodulation with AM modulated signal<br>Perform experiment to determine the frequency deviation with FM modulated signal | Explain the following terms regarding frequency modulation:-<br>a. modulation index;<br>b. deviation ratio;<br>c. frequency deviation;<br>d. system deviation;<br>e. frequency swing |

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| | problems involving 3.6 and 3.7 above. | | | | | |
| General Objectives 4 Understand the principles of amplitude modulation and frequency modulation | | | | | | |
| | 4.1 Explain the working principles of amplitude demodulators<br>4.2 Explain the working principles of frequency demodulators | Explain the working principles of amplitude demodulators<br>4.2 Explain the working principles of frequency demodulators | | | | Explain the working principles of Amplitude demodulators and Frequency demodulators |
| General Objectives 5 Understand the principles of operation of the radio receiver | | | | | | |
| | 5.1 Draw the block diagram of the following radio receivers.<br>a. straight;<br>b. super heterodyne.<br>5.2 Explain the function of each block diagram in 5.1<br>5.3 Explain the choice of intermediate frequency in the super heterodyne receiver.<br>5.4 Explain the following phenomena in | Explain as listed in specific learning oucome 5.1 to | Dismantle TV set and other tools | Illustrate with the aid of a block diagram, the working principle of an F.M. radio receiver.<br><br>Draw Block diagram of radio receiver | Encourage students to illustrate with the aid of a block diagram, the working principle of an F.M. radio receiver.<br><br>Draw Block diagram of radio Receiver. | Explain the following phenomena in super heterodyne receiver:- a. adjacent channel interference b. image interference |

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| | super heterodyne receiver:- a. adjacent channel interference b. image interference.<br>5.5 Explain the use of double super heterodyne to suppress image and adjacent channel interferences.<br>5.6 Explain the function of the automatic gain control (A.G.C.)<br>5.7 Explain with the aid of a block diagram, the working principle of an F.M. radio receiver. | | | | | Explain the function of the automatic gain control (A.G.C.)<br><br>Explain with the aid of a block diagram, the working principle of an F.M. radio receiver. |
| General Objectives 5 Know the principles of black and white television transmission | | | | | | |
| | 5.1Differentiate between Radio and Black/White T.V. Transmission<br>5.2 Explain with diagrams of the following radio transmitters using: | List out differencies between Radio and Black/White T.V. Transmission<br><br>Explain<br>a. amplitude modulation;<br>b. frequency | Radio, Black and White TV, | Draw block diagrams of the following radio transmitters using:<br>a. amplitude modulation;<br>b. frequency | Guide students to draw block diagrams of the following radio transmitters using:<br>a. amplitude modulation;<br>b. frequency | Explain<br>a. amplitude modulation;<br>b. frequency modulation.<br>and their functions<br><br>Explain how |

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| | a. amplitude modulation;<br>b. frequency modulation.<br>5.3 Explain the function of each block in 4.5.<br>5.4 Draw the block diagram of a television transmitter (black & white).<br>5.5 Explain the function of each block in 4.3.<br>5.6Explain how vision and sound signals<br>are generated separately and transmitted together. | modulation.<br>and their functions<br><br>Explain how vision and sound signals are generated separately and transmitted together.<br>Explain how vision and sound signals are generated separately and transmitted together. | <br><br><br><br><br><br>Radio, Black and White TV | modulation | modulation | vision and sound signals<br>are generated separately and transmitted together.<br><br><br>Explain how vision and sound signals<br>are generated separately and transmitted together. |
| General Objectives 6 Know various frequency bands within the radio spectrum | | | | | | |
| | 6.1 Classify Radio Frequencies<br>6.2 List the frequency ranges allocated to each of the following bands and their uses;<br>a. (e.l.f.) extremely low frequency;<br>b. (v.l.f.) very low | Show the diagrams of different types of antenna and show how Signals are propagated. | Radio, Black and White TV | Illustrate different types of antenna and show how Signals are propagated. | Show the diagrams of different types of antenna and show how Signals are propagated. | Explain the function of different types of antenna and show how Signals are propagated. |

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| | frequency<br>c. (l.f.) low frequency;<br>d. (m.f.) medium frequency;<br>e. (h.f.) high frequency;<br>f. (v.h.f.) very high frequency;<br>g. (u.h.f.) ultra high frequency;<br>h. (s.h.f.) super high frequency;<br>i. (e.h.f.) extremely high frequency. | | | | | |
| General Objectives 7 Understand the principles of electro-magnetic wave radiation | | | | | | |
| | 7.1 Explain the function of an aerial as a radiator<br>7.2Appreciate the current and voltage distribution of a dipole<br>7.7 Explain aerial impedance and radiation resistance.<br>7.4 Define an isotropic radiator<br>7.5 Define the | Explain the function of an aerial as a Radiator,<br>current and voltage distribution of a dipole,<br>aerial impedance and radiation resistance.<br><br>Define an isotropic radiator,<br>the gain of an aerial and the beamwidth of an aerial. | Aerials, textbooks, board, chalk, wave guides and coaxial cables | | | Explain aerial impedance and radiation resistance |

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| | gain of an aerial<br>7.6 Define the beamwidth of an aerial<br>7.7 Sketch the polar diagram or the radiation pattern of an aerial.<br>7.8 Sketch the horizontal and vertical plane patterns of a horizontal and vertical dipole.<br>7.9 Identify various types of aerials: e.g. Yagi, Rhombic, etc.<br>7.10 Sketch Yagi and rhombic aerials<br>7.11 Explain the effect of frequency on aerial dimensions and performance.<br>7.12 Explain the factors guiding the choice of aerials. | Explain way of sketching the horizontal and vertical plane<br>patterns of a horizontal and vertical dipole. | | | | |
| General Objectives 8 Understand the principles of radio wave propagation | | | | | | |
| | Explain the following terms in relation to | Explain wave propagation;<br>a. Ground waves; | Internet, textbook | | | Explain<br>a. Ground waves;<br>b. Sky waves; |

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| | wave propagation;<br>a. Ground waves;<br>b. Sky waves;<br>c. Space waves.<br>8.2 Explain the existence and usefulness of the troposphere.<br>8.3 Explain the effects of the troposphere on propagation below 30MHZ.<br>Explain the various layers of the ionosphere such as:<br>a. The D-layer;<br>b. The E-layer;<br>c. The F-layer.<br>8.8 Explain critical and maximum usable frequency.<br>8.5 Explain optimum working frequency.<br>Solve problems involving wave propagation. | b. Sky waves;<br>c. Space wave.<br><br>Explain troposphere and its effects on propagation.<br><br>Explain the various layers of the ionosphere such as:<br>a. The D-layer;<br>b. The E-layer;<br>c. The F-layer | | | | c. Space wave.<br><br>Explain the various layers of the ionosphere. |
| General Objectives 9 Investigate and analyze the characteristics of simple telecommunication circuits | | | | | | |
| | 9.1 Explain modulation with signals in audio frequency band | Teachers should involve the students in the experiments<br>• Ask the students to | • AM and FM demonstration units, oscilloscope, | Determine impedance, radiation resistance, | Perform experiment on amplitude modulation with | Determine the frequency deviation with FM |

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| | 9.2 Explain the effect demodulation with AM modulated signal on amplitude<br>9.3Determine the frequency deviation with FM modulated signal<br>9.4 Explain process of frequency demodulation with FM modulated signals<br>9.5 Explain process of performing experiments on superheterodyne radio receiver<br>9.6 Determine impedance, radiation resistance, gain, beam-width and radiation power of aerials<br>9.7 Determine the video, composite waveform and sync.pules of TV receiver circuits | submit their reports for assessment | frequency generator, RF and AF demonstration units,<br>super heterodyne receiver.<br>Skill G Equipment and resources | gain, beam-width and radiation power of aerials<br><br>Carryout experiment to determine the video, composite waveform and sync.pules of TV receiver circuits | signals in audio frequency band<br>9.2 Perform experiment on amplitude demodulation with AM modulated signal<br>9.3 Perform experiment to determine the frequency deviation with FM modulated signal<br>9.4 Carryout experiment on frequency demodulation with FM modulated signals<br>9.5 Perform experiments on superheterodyne radio receiver<br>9.6 Carryout experiment to determine impedance, radiation resistance, gain, beam-width and radiation power of | modulated signal<br><br>Explain process of frequency demodulation with FM modulated signals |

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| | | | | | aerials<br>9.7 Carryout experiment to determine the video, composite waveform and sync.pules of TV receiver circuits | |

Assessment: 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: NATIONAL DIPLOMA IN COMPUTER ENGINEERING TECHNOLOGY | CODE: CTE 228 | CREDIT HRS: 75 HRS<br>15 WEEK |
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| COURSE: INTRODUCTION TO MICROPROCESOR & MICRIPROGRAMMING | COURSES UNIT 4.0 | |
| Semester 4 | | |

Goal: This course is designed to enable students to acquire the basic knowledge and skill in computer technology.

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

1. Understand the concepts of microcomputer
2. Develop a structural approach to microcomputer programme
3. Understand facilities for system development
4. Use the computer in real-time control application
5. Link the computer with the peripherals and controlled loads

| Programme:National Diploma in Computer | Course code:CTE 228 | Contact Hours: |
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| Engineering | | | | | | |
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| Course: Introduction to Microprocessor & Microprogramming. | | | | | Theoretical: 2 | |
| Year:Two Semester:Four | | | Pre-requisite: None | | Practical:2 | |
| General Objective 1: Understand the concepts of microprogramming | | | | | | |
| Week | Theoretical Content | | | Practical Content | | |
| | Specific Learning Objectives | Teacher"s activities | Resources | Specific Learning Objectives | Teacher"s activities | Evaluation |
| 1-2 | 1.1 Explain the concept of microprogramming in the design phase of the control section of digital computers.<br>1.2 Analyse the concept of firmware technology as it relate to the transfer of some core function of the operating system into firmware.<br>1.3 Explain the incorporation of some supervisory function of the operating systems into firmware. | Explain the concept of microprogramming in the design phase of the control section of digital computers. Analyse the concept of firmware technology as it relate to the transfer of some core function of the operating system into firmware | White Board Computer system loaded PowerPoint and connected to overhead projector | Identify different types of computer memories and how the Multiplexer, De Multiplexer and decoder works.<br><br>Demonstrate the design of the control section of a digital computer as a control sequence of control signal | Assist students to Identify different types of computer memories and how the Multiplexer, De Multiplexer and decoder works.<br><br>Demonstrate the design of the control section of a digital computer as a control sequence of control signal | Desktop, Laptop, Tablets PCs, Handheld computers and training kits |
| General Objectives 2 Develop a structural approach to microcomputer programme | | | | | | |
| | 2.1 Store a table of commands or codes with their associated service routine addresses in the linear address | Explain a table of commands or codes with their associated | White Board<br><br>Computer system loaded PowerPoint | Identify digital systems as machines from 0 to class 4 machines<br><br>Represent control | Show students how to represent control algorithm in form of a state transition diagram | Explain how to Locate a command bit-pattern in a table in memory |

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| | space of the computer memory.<br>2.2 Locate a command bit-pattern in a table in memory and thereafter retrieve the corresponding service routine address and transfer control it.<br>2.3 Determine, which key is punched by the user on a computer keyboard by means of software keyboard scanner.<br>2.5 Execute a microcomputer program in single step mode and after each step:<br>i examine the affect ed flags registers and memory locations.<br>ii determine the full effect of the instruction just executed.<br>iii use this to locate the error in any piece of programme.<br>2.6 Write programs which:<br>i test the flags and status | service routine addresses in the linear address space of the computer memory.<br><br>Explain Ways to Locate a comman d bit-pattern in a table in memory and thereafte r retrieve the correspo nding service routine address and transfer control it. | and connected to overhead projector Desktop Computer systems<br><br>Training kits | algorithms in form of a state transition diagram (STD) or algorithmic state machine (ASM) charts<br><br>Identify the limitations of hardware logic and the justification for using microprocessors.<br><br>Use subroutines in the monitor software supplied with the system in developing applications. | Show students how to use Multiplexers, decoders, ROMs and PLAs in structured logic design | and thereafter retrieve the correspond ing service routine address and transfer control it.<br><br>Explain how to determine, which key is punched by the user on a computer keyboard by means of software keyboard scanner. |

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| | of the system being monitored.<br>ii Determine if there are error conditions.<br>iii use the error byte as a code with which to look up table and retrieve the corresponding error service.<br>iv generate instructions and message to system users. | | | | | |
| General Objectives 3 Know facilities for system development | | | | | | |
| | 3.1 Use EPROM programmers to store control programmes and data into EPROMS.<br>3.2 Use EPROM erasers to wipe out the original programming and re-program the EPROM when errors are detected.<br>3.3 Use assemblers to convert your source program in Assembly Language form to object code.<br>3.4 Use one micro to emulate another micro of different make using cross | Explain the use of EPROM programmers to store control programmes and data into EPROMS,<br>EPROM erasers to wipe out the original programming and re-program the EPROM when errors are detected. | White Board<br><br>Computer system loaded PowerPoint and connected to overhead projector<br><br>A demo desktop computer system | Use the function of an operating systems.<br><br>Identify computer language:<br>(a) Machine Code<br>(b) Assembler<br>(c) High Level Language | Guide students to<br>Use the function of an operating systems.<br><br>Identify computer language:<br>(a) Machine Code<br>(b) Assembler<br>(c) High Level Language | Practice the use EPROM programmers to store control programmes and data into EPROMS.<br><br>EPROM erasers to wipe out the original programming and re-program the EPROM when errors are detected.<br>Use |

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| | assemblers<br>3.5 Use software to simulate system behavior especially before actual application and highlight any illogical behavior that must be rectified.<br>3.6 Test out new systems in real-time using in-circuit emulators.<br>3.7 Use Dynamic Debuggers to quicly locate errors in software during system development | assemblers to convert your source program in Assembly Language form to object code,<br>one micro to emulate another micro of different make using cross assemblers | | | | assemblers to convert your source program in Assembly Language form to object code. |
| General Objectives 4 Know how to use the computer in real-time control applications. | | | | | | |
| | 4.1 Explain causes of computer delay for any pre-determined time interval by means of software.<br>4.2 Appreciate that a square wave is made up of a continuous stream of high and low logic levels of pre-determined duration.<br>4.3 Generate a square | Explain causes of computer delay for any pre-determined time interval by means of software.<br>4.2 Appreciate that a square | White Board<br><br>Computer system loaded PowerPoint and connected to overhead projector.<br><br>Computer System with Microsoft | Identify programmable and non-programmable interface data transfer.<br><br>Identify elements of a data transmission path<br>(a) Data producer and encoder<br>(b) Encoder (e.g parity encoder)<br>(c) Modulator,<br>(d) Channel; | Guide students on to draw flow charts for a typical conditional interface data transfer routine.<br><br>Draw flow charts of a typical interrupt driven data transfer routine. | Explain causes of computer delay for any pre-determined time interval by means of software.<br><br>Generate a square wave of any desired duty factor by |

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| | wave of any desired duty factor by using delay subroutines to control the pulse width.<br><br>4.4 Interface a loudspeaker to a bit of an I / O port and send a square waveform to that bit position so as to actuate the loudspeaker.<br><br>4.5 Generate special sound effects such as SIREN, burglar and fire alarms, game sounds, e.t.c. by means of software.<br><br>4.6 Develop micocmputer-based real-time clocks by:<br>i generating 1 second pulse<br>ii Counting them up to obtain minutes and hours.<br>iii displaying them in either the 12-hour or the 24-hour format.<br><br>4.7 Cause a tone of pre-determined frequency to be emitted at the touch of a given button on a key pad. | wave is made up of a continuous stream of high and low logic levels of pre-determined duration.<br><br>Explain how to develop micocmputer-based real-time clocks by:<br>i generating 1 second pulse<br>ii Counting them up to obtain minutes and hours.<br>iii displaying them in either the 12-hour or the 24-hour format.<br><br>Cause a tone of pre-determined frequency to be emitted at the touch of a given button | Office Suite or Open Office suite installed | (e) Demodulator<br>(f) Decoder,<br>(g) Receiver.<br><br>Identify the basic structure of a simple interface interrupt driven data transfer.<br><br>Use a tone receiver and decoder to detect that a particular tone has been sent.<br><br>Control a device by means of tones and infra-red source and sensor pairs | | using delay subroutines to control the pulse width |

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| | . | on a key pad. | | | | |
| General Objectives 5 Be able to link the computer with the peripherals and controlled loads | | | | | | |
| | 5.1 Interface a microcomputer to any peripheral device.<br>5.2 Operate a peripheral device by sending control patterns to an I /O port address or to a memory address.<br>5.3 Link a computer to the following peripheral devices: keyboard , printer, disk drives, VDUS, Teletypewriters, Joysticks, the mouse graph plotter, modems, etc.<br>5.4 Link a computer to the following displays: LED,7-segment liquid using display drivers.<br>5.6 State the differences between multiplexed and un-multiplexed displays | Explain 5.1 to 5.6 | White Board<br><br>Computer system loaded PowerPoint and connected to overhead projector<br><br>Computer system<br><br>Training kits | Identify a main frame, mini and micro computer systems.<br><br>Identify, describe the structure and operation of a microprocessor unit.<br><br>Identify the structure and operations of interface adapters<br><br>Demonstrate the effect of the display multiplexing | Perform an experiment to realize buffering using a microprocessor.<br><br>Perform experiments to illustrate Outline the roles of microprocessors in the design of ffg. instrumentation and control Systems<br>(a) Machine tool control;<br>(b) Process control,<br>(c) Traffic control;<br>(d) Automotive electronics;<br>(e) Instrumentation of all kinds;<br>(f) Electronic games;<br>(g) Computer systems;<br>(h) Communication | State the differences between multiplexed and un-multiplexed displays |

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| Programme: National Diploma in Computer Engineering | Course Code: CTE 223 | Credit Hours: 30 |
| Course: Operating System | Semester 4 | Theoretical: 3 Hours/week |
| Year 2 | Pre-requisite: | |
| Goal: This course is designed to teach the functions of Operating System | | |
| General Objectives:<br>On completion of this course the student should be able to:<br>1. Know the concepts of an operating system<br>2. Know the classification and different types of Operating System<br>3. Know the functions, characteristics, and components of Operating System<br>4. Know services, properties, and structure of an Operating System<br>5. Understand the general concept of system programming<br>6. Understand the use of utilities and libraries | | |

| | Theoretical Content | | | Practical Content | | |
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| | General Objective 1.0: Know the concept of an Operating System. | | | | | |
| Week | Specific Learning Outcomes | Teacher‟s activities | Resources | Specific Learning Outcomes | Teacher‟s activities | Evaluation |
| 1-2 | 1.1 Explain the generic idea of an operating system.<br>1.2 Define Operating System (OS)<br>1.3 Explain the evolution of the operating system.<br>1.4 Explain the importance of Operating Systems using real-life examples e.g. DOS, Windows, UNIX, etc.<br>1.5 Describe the basic organisation and architecture of a computer system based on operating system platform.<br>1.6 List the merits and demerits of operating system<br>1.7 Explain the goals (resource management) | Explain Operating System (OS)<br>Explain the importance of OS,<br>Explain computer organisation and architecture based on the OS | Presentation package Multimedia Projector<br>PC loaded with virtualization software with different OS installed.<br>Textbooks | | | Describe how to operate various OS |

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| | of an operating system. | | | | | |
| | General Objective 2.0: Know the classification and different types of Operating Systems. | | | | | |
| 3-5 | 2.1 Classify operating systems into closed source and open source<br>2.2 Give examples of closed-source and open-source operating system.<br>2.3 Explain types of operating system. i.e Batch, Real-time, Time-sharing, Distributed and Networking operating systems<br>2.4 Give some examples of Batch, Real-time, Timesharing, Distributed and Networking operating systems.<br>2.5 List the advantages and disadvantages of the various types of operating system.<br>2.6 Explain the differences between Hard real time operating system and soft real time operating | Explain closed source and open source operating system with examples.<br>Classify operating systems into batch, real time, timesharing and networking. Define each of them, with examples<br>Textbooks | Presentation package Multimedia Projector<br>PC loaded with virtualization software with different OS installed. | | | Explain the design of various OS |

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| | system<br>2.7 Explain operating system computing environments, e.g. Mobile system, Distributed system, Client-server system, and virtualization system. | | | | | |
| | General Objective 3.0: Know the functions, characteristics, and components of Operating Systems. | | | | | |
| 6 - 7 | 3.1 State the functions of operating systems in relation to memory management, processor management, device management and interrupt handling and information management.<br>3.2 State the characteristics of operating systems: concurrency, sharing, long-term storage and non-determinacy<br>3.3 State the features of operating systems: efficiency, reliability, maintainability and size. | Explain how operating system aids the functionality of the memory, processor, I/O devices and interrupt handlers.<br>Explain the characteristics of operating systems.<br>Explain the features of operating systems.<br>Explain the components of an operating system | Presentation package<br>Multimedia Projector<br>PC loaded with virtualization software with different OS installed.<br>Textbooks | | | Practice the use of different DOS commands. |

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| | 3.4 Explain the components of operating system, e.g kernel, Process execution, Interrupt, Memory management, Multitasking, Networking, User interface, and Security.<br><br>3.5 Explain the parameters used to measure operating system performance, e.g Throughput, Response time and Execution time.<br><br>3.6 Explain operating systems files: - IO.SYS, COMMAND.COM, CONFIG.SYS<br><br>3.7 Describe the functions of the basic DOS commands; i.e. FORMAT, DIR, CHKDSK, TYPE, BACKUP, MODE, SYS, AUTOEXEC, DISCOMP, FDISK, etc. | Define throughput, response time and Execution time<br><br>Describe operating systems files; IO.SYS, COMMAND.COM, CONFIG.SYS<br><br>Explain the functions of DOS commands | | | | Explain operating systems files: - IO.SYS, COMMAND. COM, CONFIG.SYS |

| General Objective 4.0: Know the services, properties, and structure of an Operating System. | | | | | | |
|---|---|---|---|---|---|---|
| 8 - 9 | 4.1 Explain the services provided by the operating system: - User interface, Program execution, I/O operation, File system manipulation, Communication, Error detection, Resource Allocation, and protection.<br>4.2 Explain the properties of an operating system: - Batch processing, Multitasking, Multiprogramming, Interactivity, Real time system, Spooling, Distributed Environment.<br>4.3 List the advantages and disadvantages of each of the properties of an operating system.<br>4.4 Describe the structure of an operating system, | Explain the services provided by the operating system.<br><br>Describe the properties of an operating system. | Presentation package<br><br>Multimedia Projector<br><br>PC loaded with virtualization software with different OS installed.<br><br>Textbooks | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | i.e kernel, system calls, shells and command interpreter, processes, and files.<br>4.5 Explain the architecture of OS (Monolithic, Micro-kernel, Layered, Kernel)<br>4.6 Explain Process management<br>4.7 Explain process states and process control block (PCB)<br>4.8 Describe process scheduling and types of scheduling.<br>4.9 Explain the concept of CPU scheduling and its algorithm. | | | | | |
| General Objective 5.0: Understand the general concept of system programming. | | | | | | |
| 10-11 | 5.1 Define Systems Programming.<br>5.2 Define Application Programming<br>5.3 Differentiate between a systems program and an application program. | Describe System Programming.<br><br>Define Application Programming.<br><br>Explain the difference | Textbooks<br><br>Presentation package<br><br>Multimedia Projector | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 5.4 Identify areas involved in systems programming e.g. compilers, assemblers, operating systems, device drivers, interrupt handlers.<br>5.5 Explain the differences between Operating system and application programs. | between system program and application program. Explain compilers, assemblers etc. | PC loaded with virtualization software with different OS installed. | | | |
| | General Objective 6.0: Understand the use of utilities and libraries | | | | | |
| 12-13 | 6.1 Define Utilities<br>6.2 Explain Utilities<br>6.3 Define Library<br>6.4 Explain Libraries<br>6.5 Relate utilities to Libraries<br>6.6 Implement libraries and utility program | Explain utilities and libraries, state their types. | Presentation package Multimedia Projector<br>PC loaded with virtualization software with different OS installed.<br>Textbooks | | | |
| | General Objective 7.0: Understand Input / Output devices handlers | | | | | |

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|---|---|---|---|---|---|---|
| 14-15 | 7.1 Explain CPU states.<br>7.2 Define I/O processing.<br>7.3 Explain Direct Memory Access<br>7.4 Explain polling<br>7.5 Describe interrupts, masking traps<br>7.6 List out the different types of interrupt, i.e Hardware and Software Interrupt<br>7.7 Describe traps<br>7.8 Differentiate between traps and interrupts<br>7.9 Describe deadlock.<br>7.10 Explain how to prevent deadlock.<br>7.11 Explain Semaphore, its types and operations | Explain I/O processing<br><br>Explain interrupts<br><br>Explain the difference between traps and interrupts<br><br>Define interrupt vector<br><br>Describe the use of interrupt vector<br><br>State the use of masking in relation to interrupt<br><br>Describe traps<br><br>Explain levels of interrupt | Presentation package<br><br>Multimedia Projector<br><br>PC loaded with virtualization software with different OS installed<br><br>Textbooks | | | |

LIST OF MINIMUM RESOURCES FOR ND COMPUTE ENGINEERING TECHNOLOGY

1. LABORATORIES

| EXCLUSIVE | SHARED |
|---|---|
| 1. Computer Technology | 1. Basic Electricity, Measurement and Instrumentation (*See ND Electrical/Electronic Engineering Technology Curriculum for details*)<br>2. Electronics/Communication (*See ND Electrical/Electronic Engineering Technology Curriculum for details*) |

2. WORKSHOPS

| EXCLUSIVE | SHARED |
|---|---|
| 1. Computer Maintenance and Repairs<br>2. Computer Networking | 1. Electrical Installation (*See ND Electrical/Electronic Engineering Technology Curriculum for details*)<br>2. Electrical Maintenance and Repairs (*See ND Electrical/Electronic Engineering Technology Curriculum for details*)<br>3. Mechanical (*See ND Mechanical Engineering Technology Curriculum for details*) |

3. OTHER FACILITES

| EXCLUSIVE | SHARED |
|---|---|
| 1. Computer Studio | 1. Drawing Studio (*See ND Mechanical Engineering Technology Curriculum for details*) |

A. COMPUTER TECHNOLOOGY LABORATORY (NATIONAL DIPLOMA)

| S/N | DESCRIPTION OF ITEMS | QUANTITY |
|---|---|---|
| 1. | Logic Tutors | 5 |
| 2. | Digital system trainer | 5 |
| 3. | Microcomputer interface trainer kit | 5 |
| 4. | Microcomputer trainer | 5 |
| 5. | Oscilloscope (Dual trace, high frequency 100 MHz) | 3 |
| 6. | Digital Oscilloscope, 200 MHz and above | 3 |
| 7. | Logic probe | 5 |
| 8. | Logic pulser | 5 |
| 9. | Digital Multimeter | 5 |
| 10. | IC Tester | 5 |
| 11. | Frequency counter | 5 |
| 12. | Function generator | 5 |
| 13. | DC Power supply (0-12V) | 5 |
| 14. | Breadboard | 5 |
| 15. | Discrete components and Integrated Circuits (Analogue and Digital) | Lot |
| 16. | Micro-computer | 5 |
| 17. | Fire extinguisher | 1 |
| 18. | First aid box | 1 |
| 19. | Safety bucket | 1 |
| 20. | Safety posters | 6 |

B. COMPUTER MAINTENANCE AND REPAIRS WORKSHOP (NATIONAL DIPLOMA)

| S/N | DESCRIPTION OF ITEMS | QUANTITY |
|---|---|---|
| 1. | Micro-computer with Linux operating system (Functional) | 1 |
| 2. | Micro-computers with Microsoft operating system (Functional) | 1 |

| | | |
|---|---|---|
| 3. | Micro-computers with Macintosh operating system (Functional) | 1 |
| 4. | Micro-computer (Serviceable) | 2 |
| 5. | Laptop (Serviceable) | 2 |
| 6. | Smart phones (Servicable) | 2 |
| 7. | Tablet computer (Serviceable) | 2 |
| 8. | Model of internal and external parts of the computer system | 1 |
| 9. | LaserJet Printer (Functional) | 1 |
| 10. | LaserJet Printer (Serviceable) | 1 |
| 11. | InkJet Printer (Functional) | 1 |
| 12. | InkJet Printer (Serviceable) | 1 |
| 13. | Plotters | 1 |
| 14. | Scanner | 1 |
| 15. | Multimedia projector | 1 |
| 16. | Computer repairs toolbox | 10 |
| 17. | Soldering iron (power rating not more than 20 watt) | 15 |
| 18. | Soldering sucker | 15 |
| 19. | Soldering station | 5 |
| 20. | Air blower | 2 |
| 21. | Digital Multimeters | 10 |
| 22. | IC extractors/insertion | 5 |
| 23. | Digital Oscilloscope dual trace 100MHz | 2 |
| 24. | Replacement Computer components/parts:<br>- Input devices (keyboard, mouse, camera etc)<br>- Output devices (LCD monitor, speakers etc)<br>- Secondary storage devices (Hard disk drive, CD/DVD drive etc)<br>- Processor and primary storage devices (CPU, RAM, Motherboard etc)<br>- Power supply<br>- Network Interface cards<br>- Fans | Lot |

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|---|---|---|
| | - Video adapter<br>- Sound Adapter | |
| 25. | DC Power Supply | 3 |
| 26. | Cleaning kit:<br>Drive lens<br>cleaner<br>Paint brush (2” and<br>3”) Duster (Napkin) | <br>3<br>3<br>3 |
| 27. | Computer, printers and smartphone manuals | Varieties |
| 28. | Washing pans | 5 |
| 29. | Mobile phone repair kit | 5 |
| 30. | Anti static wrist band | Lot |
| 31. | Antivirus software tool | 1 |
| 32. | Fire extinguisher | 1 |
| 33. | First aid box | 1 |
| 34. | Safety bucket | 1 |
| 35. | Safety posters | 6 |

C. COMPUTER NETWORKING WORKSHOP (NATIONAL DIPLOMA)

| S/N | DESCRIPTION OF ITEMS | QUANTITY |
|---|---|---|
| 1. | Network testers | 2 |
| 2. | Computer tool kits | 5 |
| 3. | Strippers | 2 |
| 4. | Compression and Crimp tools | 2 |
| 5. | Insertion and Extraction tools | 2 |
| 6. | Switches | 2 |
| 7. | Punch down | 2 |
| 8. | Computer | 5 |
| 9. | Ethernet Cable | Lot |
| 10. | RJ 45 | Lot |
| 11. | Digital Multimeter | 5 |
| 12. | LAN Routers | 2 |

| | | |
|---|---|---|
| 13. | Wireless Router | 2 |
| 14. | Internet Modem | 2 |
| 15. | Cable tester | 2 |
| 16. | Fire extinguisher | 1 |
| 17. | First aid box | 1 |
| 18. | Safety bucket | 1 |
| 19. | Safety posters | 6 |

D. COMPUTER STUDIO

| S/N | DESCRIPTION OF ITEMS | QUANTITY |
|---|---|---|
| 1. | Computer systems | 15 |
| 2. | Printer (All-in-one) | 1 |
| 3. | Multimedia Projector | 1 |
| 4. | Projector screen | 1 |
| 5. | Internet modem | 1 |
| 6. | Software packages<br>- Operating system (Windows, Linux, etc)<br>- Simulation software (Multisim, Proteus Design, MATLAB, Electronic workbench, Packet Tracer, Scilab, Octave, etc)<br>- Application suites (MS Office suite etc)<br>- Integrated Development Environment (MS Visual studio, NetBeans etc)<br>- Word processing<br>- Spreadsheet<br>- Statistical packages<br>- Graphics packages<br>- Educational packages<br>- BASIC<br>- C Language<br>- Assembler | Varieties |
| 7. | Fire extinguisher | 1 |

| | | |
|---|---|---|
| 8. | First aid box | 1 |
| 9. | Safety bucket | 1 |
| 10. | Safety posters | 6 |

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