NATIONAL BOARD FOR TECHNICAL EDUCATION

NATIONAL DIPLOMA (ND)

IN

CIVIL ENGINEERING TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

2001

PLOT 'B' BIDA ROAD, PM.B. 2239, KADUNA - NIGERIA

GENERAL INFORMATION

1.0 **CERTIFICATION AND TITLE OF THE PROGRAMME**:
The certificate to be awarded and the programme title shall read:

"NATIONAL DIPLOMA IN CIVIL ENGINEERING TECHNOLOGY"

A transcript showing all the courses taken and grades obtained shall be issued on demand.

2.0 **GOALS AND OBJECTIVES**

2.1 **National Diploma Programme**:
The National Diploma Programme in Civil Engineering Technology is aimed at producing technicians for both the public and private sectors of the economy who can also be self-establishing and self-reliant.

On the completion of this programme, the diplomate should be able to:

i. Function as a foreman on a construction site
ii. Produce good Civil Engineering drawings and schedules
iii. Supervise Civil Engineering processes
iv. Carry out necessary tests on Engineering materials
v. Interpret Civil Engineering drawings
vi. Interpret surveyor's measurements
vii. Setout Civil Engineering project
viii. Carry out maintenance of Civil Engineering works

3.0 **ENTRY REQUIREMENTS:**

3.1 **National Diploma**
Applicants with any of the following qualifications may be considered for admission into the National Diploma Programme by direct entry:

i. S.S.S.C or its equivalent (Teachers Grade II, NTC, WASC, G.C.E) with passes at credit level in Mathematics, Physics, a Science subject (i.e. Chemistry, Biology, or Agricultural Science), and one other subject and an ordinary pass in English Language at not more than two sittings. In addition credit or ordinary pass in any of the following subjects will be an advantage: Wood Work, Metal Work, Auto-mechanics, Basic Electronics, Basic Electricity, Technical Drawing, Fine Art;
ii. Four passes at credit level in relevant subjects as stated in (i) above obtained at the final examination of an NBTE recognised preliminary ND Programme offered in a Polytechnic or similar post-secondary technical institution provided that students admitted into the Pre-ND have a Pass in English Language.

4.0 CURRICULUM

4.1 The curriculum of the ND programme consists of four main components. These are:

a. General Studies/Education
b. Foundation Courses
c. Professional Courses
d. Supervised Industrial Works Experience Scheme (SIWES)

4.2 The General Education component shall include courses in:

Art and Humanities - English Language, Communication and History. These are compulsory.
Social Studies - Citizenship (the Nigerian Constitution), Political Science, Sociology, Philosophy, Geography, Entrepreneurship, Philosophy of Science and Sociology are compulsory.
Physical and Health Education (one semester credit only).

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

4. 4 **Foundation Courses** include courses in Economics, Mathematics, Pure Science, Computer Applications, Technical Drawing, Descriptive Geometry, Statistics, etc. The number of hours will vary with the programme and may account for about 10-15% of the total contact hours.

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

4.5.2 Supervised 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

5.1 **ND Programme:**

The structure of the ND programme consists of four semesters of classroom, laboratory and workshop activities in the college and a semester (3-4 months) of Supervised Industrial Work Experience Scheme (SIWES). Each semester shall be of 17 weeks duration made up as follows:

15 contact weeks of teaching, i.e. lecture recitation and practical exercises, etc. and 2 weeks for tests, quizzes, examinations and registration.

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

6.0 ACCREDITATION

The programme offered shall be accredited by the NBTE before the diplomates shall be awarded the diploma certificate. Details about the process of accrediting a programme for the award of the ND or HND are available from the Executive Secretary Programmes Department, National Board for Technical Education, Plot 'B' Bida Road, P.M.B. 2239, Kaduna, Nigeria.

7.0 CONDITIONS FOR THE AWARD OF THE 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 between semester 90 and 100 % credit units depending on the programme. Diploma Certificate shall be awarded based on the following classifications:- 90 and 100.

Distinction - CGPA 3.50 - 4.0
Upper Credit - CGPA 3.00 - 3.49
Lower Credit - CGPA 2.50 - 2.99
Pass - CGPA 2.00 - 2.49

8.0 GUIDANCE NOTES FOR TEACHERS TEACHING 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 has been adopted; thus making each of the professional modules, when completed self-sufficient and providing 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 institutions and industry, the curriculum content has been written in terms of behavioural objectives, so that it is clear to all, the expected performance of the student who successfully completed some of the courses or the diplomates of the programme is clearly defined. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

8.4 The teaching of the theory and practical work should, as much as possible, be intergrated. Practical exercise, 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 depending on the course objectives and content.

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

(i) Institutions offering the ND Programme shall arrange to place the students in industry. By April 30th of each year, six copies of the master list showing where each student has been placed shall be submitted to the Executive Secretary NBTE which shall, in turn, authenticate the list and forward it to the Industrial Training Fund.

(ii) The Placement Officer should discuss and agree with industry on the following:

(a) 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.

(b) the industry-based supervisor of the students during the period, likewise the institution-based supervisor.

(c) the evaluation of the student during the period. It should be noted that the final grading of the student during the period of 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, cognisance should be taken of the following items:

i. Punctuality
ii. Attendance
iii. General Attitude to Work
iv. Respect for authority
v. Interest in the field/technical area
vi. Technical competence as a potential technician in his field.

9.3 Grading of SIWES

To ensure uniformity of grading scales, the institution shall ensure that the uniform grading of student's work which has been agreed to by all polytechnics is adopted

9.4 The Institution Based Supervisor

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

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:

i. there is another visit six weeks after the first visit; and

ii. a final visit in the last month of the attachment.

9.6 **Stipend for Students on 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.

TABLE OF CONTENTS

NATIONAL DIPLOMA IN CIVIL ENGINEERING TECHNOLOGY

YEAR ONE

SEMESTER ONE

Course Code	**Course Title**	**L**	**T**	**P**	**CU**	**CH**	**Pre-requisite**
SUG 101	Basic Principles in Surveying I	1	0	3	2	4	'O' Level Maths. & Physics
MEC 101	Technical Drawing	1	0	3	2	4	-
CEC 101	Structural Mechanics	1	1	0	2	2	'O' Level Physics
CEC 103	Workshop Technology I	0	0	4	1	4	& Maths
CEC 105	Civil Engineering Construction I	2	0	2	3	4	-
MTH 112	Algebra and Elementary Trigonometry	2	0	0	2	2	-
CEC 107	Introduction to Fluid Mechanics	1	0	2	2	3	
STA 111	Introduction to Statistics	2	0	0	2	2	'O' level Math Physics
GNS 101	Use of English I	2	0	0	2	2	'O' Level Maths
GNS 111	Citizenship Education I	2	0	0	2	2	
GNS 221	Physical and Health Education	0	0	1	1	1	'O' Level English
	TOTAL	**14**	**1**	**15**	**21**	**30**	

SEMESTER TWO

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
SUG 102	Basic Principles in Surveying II	1	0	3	3	4	SUG 101
MEC 102	Descriptive Geometry	1	0	2	2	3	MEC 101
CEC 102	Introductory Hydrology	1	0	2	2	3	CEC 107
CEC 104	Science and Properties of Materials	2	0	3	3	5	-
CEC 106	Strength of Materials	2	1	1	3	4	CEC 101
CEC 108	Engineering Geology and Basic Soil Mechanics	2	0	3	3	5	-
CEC 110	Civil Engineering Construction II	2	0	2	3	4	CEC 105
MTH 211	Calculus	2	0	0	2	2	MTH 111
GNS 201	Use of English II	2	0	0	2	2	GNS 101
SDV 210	Entrepreneurship Development I	2	0	1	2	2	-
	TOTAL	**17**	**1**	**17**	**24**	**35**	

NATIONAL DIPLOMA IN CIVIL ENGINEERING TECHNOLOGY

YEAR TWO

SEMESTER ONE

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
SUG 208	Engineering Survey I	2	0	3	3	5	SUG 102
CEC 201	Hydraulics and Hydrology	2	0	3	3	5	CEC 102
CEC 203	Workshop Technology II	0	0	4	1	4	CEC 103
CEC 205	Theory of Structures I	2	1	0	3	3	CEC 106
CEC 207	Hydrogeology	1	0	1	1	1	CEC 102
CEC 209	Civil Engineering Drawing I	1	0	3	2	2	MEC 102
CEC 211	Civil Engineering Construction III	2	0	2	3	4	CEC 110
MTH 122	Trigonometry and Analytical Geometry	2	0	0	2	2	MATH 112
SDV 211	Entrepreneurship development II	1	0	2	2	3	-
ICT 201	Introduction to Computing	2	0	2	3	4	-
	TOTAL	**15**	**1**	**20**	**22**	**34**	

SEMESTER TWO

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
CEC 202	Water Supply and Sanitary Engineering	2	0	3	3	5	CEC 202 & 107
CEC 204	Introduction to Highway Engineering	2	0	1	2	2	CEC108 & SUG 208
CEC 206	Introduction to Structural Design	2	0	0	2	2	CEC 205
CEC 208	Soil Science and Irrigation Engineering	1	0	3	2	4	CEC 108 & 207
CEC 210	Civil Engineering Drawing II	1	0	3	2	4	CEC 209
CEC 212	Soil Mechanics I	2	0	3	3	5	CEC 108
CEC 214	Engineering Measurement & Evaluation	2	0	0	2	2	MTH 122
GIT 201	Elements of Geo-informatics	1	0	3	2	4	CEC 209
ICT 102	Introduction to Programming Using Q-Basic	2	0	2	3	4	ICT 101
CEC 216	Technical Report writing	1	0	1	1	2	-
CEC 242	Construction Management	2	0	0	2	2	-
	TOTAL	**18**	**0**	**19**	**24**	**36**	

GENERAL STUDIES COURSES

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

9 - 11	**CORRESPONDENCE** 3.1 List the various type of correspondence, e.g. letter, memo, circular, e.t.c. 3.2 Explain the various parts of a letter. 3.3 Differentiate between formal and informal letter format. 3.4 Explain the characteristics of styles suitable for formal and informal letters. 3.5 Explain the functions of the first, middle and last paragraphs. 3.6 Write a formal and informal letter.	Give students assignments on various type of correspondence.	Chalk boards; Text-books, Samples of Formal and informal letters.
12 - 15	**COMPREHENSION AND INTERPRETATION** 4.1 Identify main ideas in a given passage. 4.2 Differentiate the main ideas from the details in a passage. 4.3 Use the main idea to anticipate specific details in a passage. 4.4 Use context clues to aid comprehension. 4.5 Identify relationship patterns of ideas in a passage. 4.6 Use context clues such as definitions, restatements and examples to derive meanings. 4.4 Interpret figurative language in a passage. 4.5 Draw conclusions from available information.	Teachers should give necessary aids that will assist the comprehension of passage.	Chalk board; Text-books, Samples of]Formal and informal letters.

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination make up for the remaining 60% of the total score.

PROGRAMME: NATIONAL DIPLOMA IN CIVIL ENGINEERING			
Course: USE OF ENGLISH II	**Course Code: GNS 201**	**Contact Hours 2HRS/WK**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the rules of grammar**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 – 3	1.0 Define the phrase 1.2 Explain the different types of phrases, i.e, structural and functional 1.3 Define the clause 1.4 Explain the different types of clauses i.e structural and functional 1.5 Define the sentence 1.6 Explain the different types of sentences, i.e structural and function Explain the constitution of different types of sentences	Ask the students: to identify the different types of phrases to define a clause and to identify the different types of clauses to define a sentence and to identify the different types of sentences assess the students on the construction of different types of sentences	Chalk, blackboard, duster Recommended textbook, lecture notes, etc.
	General Objective 2.0: Know how to write good essays		
4 – 5	2.1 List the different types of essays 2.2 Explain the features of each type of essay listed in 2.1 above 2.3 Generate/gather relevant information on a given topic 2.4 Draw up a good outline 2.5 Write a good essay on a given topic	Ask the students to list the different types of essays and to identify the features of each types of essay list above Assess the students on essay writing	Chalk, blackboard, duster Recommended textbook, lecture notes, etc.
	General Objective 3.0: Understand the difference between denotative and connotative uses of words		
6 – 8	Explain the term denotation Identify words used denotatively Explain the term connotation Identify words used connotatively Use words connotatively Compare denotative and connotative usage in groups of synonyms, e.g, women, lady, female, client, customer, patient, fear, terror, dread etc.	Ask the students to define the terms denotation and connotation and how to identify words used denotatively connotatively Assess the students	Chalk, blackboard, duster Recommended textbooks, lecture notes, etc.

	General Objective 4.0: Understand the techniques of comprehension and summary writing		
9 - 12	4.1 Answer questions on comprehension passage at a higher level of difficulty 4.2 Give contextual explanations to statements from the texts used 4.3 Identify colloquialisms, slangs and jargons 4.4 Explain summary writing 4.5 Distinguish between types of summary writing 4.6 Explain the steps in summary writing 4.7 Write, within a specified length, a goal summary of a given passage	Ask the students to distinguish the various types of summary writing and the steps in summary writing Give the students passages to summarise Assess the students	Chalk, blackboard, duster Recommended textbooks, lecture notes, etc
	General Objective 5.0: Appreciate literature in English		
13 - 15	5.1 Describe drama 5.2 Explain the types of drama 5.3 Explain the terminology of drama, e.g, act, resolution, conflict, denouement, etc 5.4 Distinguish between radio drama and television drama 5.5 Answer an essay question on a given drama text	Ask the students: to identify the various types of drama and to explain the terminology of drama to differentiate between radio drama and television drama to answer essay question on a given drama text. Assess the students	Television, video cassette recorder, radio cassette player

PROGRAMME: NATIONAL DIPLOMA IN CIVIL ENGINEERING			
Course: CITIZENSHIP EDUCATION	**Course Code: GNS 111**	**Contact Hours 2HRS/WEEK**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the Constitution of Nigeria**		
	Specific Learning Outcome:	Teachers Activities	**Resources**
1-4	1.1 Explain the term constitution 1.2 Distinguish the different types of constitution 1.3 Highlight some provisions of an International Constitution 1.4 Explain the effectiveness of International Constitution 1.5 Explain the supremacy of the Nigerian Constitution to other laws with emphasis on the 1989 constitution 1.6 Evaluate the main parts of the Nigeria Constitution 1.7 Draft a constitution for an association 1.8 Trace the historical development of the Nigerian Constitution 1.9 Discuss the merits and demerits of each of the Nigerian constitutions 1.10 Explain the concept of "rule of law"	Ask the students: what their understand by the term constitution and to distinguish the different rules of constitution known to explain the effectiveness of International Constitution to explain Nigerian Constitution to other laws. To identify the main parts of the Nigerian Constitution. Assess to the students by given the assignment to draft a constitution for an association	Chalkboard, duster
	General Objective: 2.0 Understand the federal system of government in Nigeria		
5-7	2.1 Describe a federation 2.2 Distinguish a federation from a confederation 2.3 Outline the basis for the federal system in Nigeria 2.4 Examine the evolution, structure and functions of the federal system in Nigeria. 2.5 Analyse the relationships among the three tiers of government in Nigeria 2.6 Evaluate the revenue allocation formula in operation in Nigeria 2.7 Compare and contrast other federation with Nigeria11	Ask the students: to describe a federation and to differentiate between a federation and a confederation to define the functions of the federal system in Nigeria and the relationship among the three tiers of government to evaluate the revenue allocation formula operation in Nigeria	Chalk, blackboard, duster

	General Objective: 3.0 Know the constitutional rights and obligations of Nigerian citizens		
8-9	3.1 Examine the significance of rights and obligations in Nigeria 3.2 Assess government's protection of fundamental rights as contained in the Nigerian constitution 3.3 Evaluate the responsibilities and duties of Nigerian citizenships and the benefits for performing them 3.4 Assess the responsibilities and duties of constituted authority to the people 3.5 Evaluate the responsibilities and duties of government to the People	Ask the students to identify the responsibilities and duties of Nigerian citizenship	Chalk, blackboard, duster
	General Objective 4.0: Understand Citizenships		
10-12	4.1 Discuss the significance of citizenship 4.2 Analyse the principles and benefits of citizenship 4.3 Explain the difference in the modes of acquiring citizenship 4.4 Evaluate the merits and demerits of each type of citizenship 4.4 Analyse the basis for the acquisition and withdrawal of Nigerian citizenship 4.5 Examine the benefits derivable from Nigeria citizenship	Ask the students: to discuss and analyse the principles and benefits of citizenship to analyse the basis for the acquisition and withdrawal of Nigerian citizenship	Chalk, blackboard, duster
	General Objective 5.0: Fundamental objectives and directive principles of state policy in Nigeria		
	5.1 State the fundamental obligations of government as provided in the constitution 5.2 Explain the general provisions of the fundamental objectives and directive principles of state policy 5.3 Explain the political, economic, social and education policies of Nigeria 5.4 Explain the directive principles and policy of the Nigerian government on culture, the mass media, national ethics and duties of the citizen 5.5 Assess the conformity observance and application of the fundamental objectives and directive principles of state policy by governments and people of Nigeria. 5.6 Recommend improvements on the provision conformity, observance and application of the fundamental objectives and directive principles of state policy	Ask the students to explain the directive principles and policy of the Nigerian Government on cultures, the mass media, national ethnics and duties of the citizen	Chalk, blackboard, duster

MATHEMATICS COURSES

ALGEBRA AND ELEMENTARY TRIGONOMETRY (MTH 112)

General Objectives

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

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

COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY	COURSE CODE: MTH 112	CONTACT HOURS: 15 HRS LECTURE15 HRS TUTORIAL

Course Specification: Theoretical Content

WEEK	General Objective 1.0: Understand laws of indices and their applications in simplifying algebra expressions		
	Specific Learning Outcomes	**Teacher Activities**	**Resources**
1	1.1 Define index 1.2 Establish the laws of indices 1.3 Solve simple problems using the laws of indices.		**Chalkboard, Textbooks, Calculators.**
	General Objective 2.0: Understand Theory of logarithms surds and their applications in manipulating expression		
2 - 3	2.1 Define logarithm 2.2 Establish the four basic laws of logarithm 2.3 Solve simple logarithm problem 2.4 Define natural logarithm and common logarithm. 2.5 Define characteristic and mantissa 2.6 Read the logarithmic table for given numbers 2.7 Simplify numerical expressions using log tables e.g. e.g. 18 D = 3%4JPC^2 Λ M^{B,} find D when J = 0935, e.g. θ = 35, P = 1.6 10^6, C = 55, M = 0 0025. π = 3.142 2.8 Apply logarithm in solving non-linear equations. e.g. $y = ax^n$; logy - log a + n log x; $y = bc^x$ = logy = logb + xlogc; Y = a + bx^n B Log (Y B D) = Logb + nlogx., 2.9 Define surds 2.10 Reduce a surd into it=s simplest form 2.11 Solve simple problems on surds	Ask the students to solve logarithmic and surd related problems	- do -
	General Objective 3.0: Understand Principles underlying the construction of Charts and graphs		
4	3.1 Construct graphs of functions fractions such as Y = ax +b,n = 1,2 Y = CST (a+x) Y = ax^k, including cases of asymbles 3.2 Apply knowledge from 3.1 in determination as laws from experimental data.	Ask the students to draw graphs	-do-
	General Objective 4.0: Know the different methods of solving quadratic equations		
5	4.1 Solve quadratic equations by factorization 4.2 Solve quadratic equations by method of completing squares. 4.3 Solve quadratic equations by formula 4.4 Discriminate the roots.	Ask the students to solve quadratic equations	

	Specific Learning Outcomes	Teacher Activities	Resources
	4.5 Form equations whose roots are given in different methods.		-do-
	General Objective 5.0: Understand Permutations and Combinations		
6	5.1 Define permutation 5.2 State examples of permutations 5.3 Define combination 5.4 State examples of combination 5.5 Establish the theorem nPr = n !/[(n-r)!]giving examples e.g. number of ways of collecting two out of 8 balls	Give exercises on permutation and combination to them	-do-
	General Objective 6.0: Understand the concept of set theory		
7	6.1 Establish ${}^{n}C_{r} = {}^{n}C_{n}$ B r. 6.2 Define sets, subsets, and null sets 6.3 Define union, inter-section and completion of sets 6.4 Draw Venn diagrams to demonstrate the concepts in 6.1 B 6.3 above. 6.5 Calculate the size or number of elements in a given set.	-do-	-do-
	General Objectives 7.0: Understand the properties of arithmetic and geometric progressions		
8 - 9	7.1 Define an Arithmetic progression (A.P.) 7.2 Obtain the formula for nth term and the first n terms of an A.P. 7.3 Give examples of the above e.g. find the 20^{th} term of the series e.g. 2 + 4 + 6 + Y.. Find also the series of the first 20 terms. 7.4 Define a geometric progression (G.P.) 7.5 Obtain the formula for the nth term and the first n terms of a geometric series. 7.6 State examples of 7.5 above e.g. given the sequences 1/3, 1,3 Y find the 20^{th} term and hence the sum of the 1^{st} 2o terms. 7.7 Define Arithmetic Mean (AM) and Geometric Mean (G.M.) 7.8 Define convergency of series. 7.9 Define divergence of series.	Ask the students to apply progression to solve problems	-do-
	General Objectives 8.0: Understand the binomial theorem and it=s application in the expansion of expressions and in approximations.		
	8.1 Explain the method of mathematical induction 8.2 State and prove the binomial theorem for a positive integral index. 8.3 Expand expressions of the forms	State the importance and application of the theorem	

	Specific Learning Outcomes	Teacher Activities	Resources
10	$(x + y)^2$, $(x^2$ B $\underline{1})^s$ applying binominal theorem 8.4 Find the coefficient of a particular term in the expansion of simple binomial expressions. 8.5 Find the middle term in the expansion of binomial expression 8.6 State the binomial theorem for a rational index. 8.7 Expand expressions of the form: $(1 + x)^{-1}$, $(1$ B $x)^2$, $(1$ B $x)^{-a}$ applying binomial theorem 8.8 Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1 + x)^{2,}$ $(1$ B $x)^a$ to a stated degree of accuracy applying | scalar expressions.		-do-
11	9.1 State the definitions and representations of vectors. 9.2 Define a position vector. 9.3 Define unit vector 9.4 Explain scalar multiple of a vector 9.5 List the characteristics of parallel vectors 9.6 Identify quantities that may be classified as vector e.g. displacement velocity, acceleration, force etc. 9.7 Compute the modulus of any given vector up to 2 and 3 dimensions. 9.8 State the parallelogram law in solving problems including addition and subtraction of vectors 9.9 Apply the parallelogram law in solving problems including addition and subtraction of vectors. 9.10 Explain the concept of components of a vector and the meaning of orthogonal components. 9.11 Resolve a vector into its orthogonal components. 9.12 List characteristics of coplanar localized vectors. 9.13 Define the resultant or composition of coplanar vectors.	Apply the techniques of vectors to solve various problems	-do-
	General Objectives 9.0: Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems		
	9.14 Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. 9.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. 9.16 Apply vectoral techniques in solving problems involving	□ Apply the techniques of vector to solve various problems	

	Specific Learning Outcomes	Teacher Activities	Resources
	relative velocity.		-do-
12	9.17 State the scalar product of two vectors. 9.18 Compute the scalar product of given vectors. 9.19 Define the cross product of the vector product or two vectors. 9.20 Calculate the direction ratios of given vectors. 9.21 Calculate the angle between two vectors using the scalar product.		
	General Objectives 10.0: Understand the Concept of equations and apply same to engineering problems		
13 - 14	10.1 Explain the concept of equation, ie. A = B where A and B are expressions. 10.2 List different types of equations:- Linear, quadratic, cubic, etc. 10.3 State examples of linear simultaneous equations with two unknowns and simultaneous equations with at least one quadratic equation. 10.4 Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation. 10.5 Apply the algebraic and graphical methods in solving two simultaneous quadratic equations. 10.6 Define a determinant of n^{th} order. 10.7 Apply determinants of order 2 and 3 in solving simultaneous linear equations.	Ask the student to solve various equations as indicated in section 10	-do-
	General Objectives 11.0: Understand the definition, manipulation and application of trigonometric functions		
15	11.1 Define the basic trigonometric ratios, sine, cosine and tangent of an angle. 11.2 Derive the other trigonometric ratios; cosecant, secant and cotangent using the basic trigonometric ratios in 11.1 above. 11.3 Derive identities involving the trigonometric ratios of the form; $Cos^2\theta+Sin^2\theta = 1$, $Sec^2\theta = 1 + tan^2\theta$, etc. 11.4 Derive the compound angle formulae for sin (A+B), Cos (A+B) and Tan (A+B).	Define and Derive the trigonometric ratios and identities	-do-

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

CALCULUS (MTH 211)

General Objectives

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

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

PROGRAMME: NATIONAL DIPLOMA IN CIVIL ENGINEERING			
COURSE : CALCULUS		**Course Code: MTH 211**	**Contact Hours 3/0/0**
Course Specification: Theoretical Content			
WEEK	**General Objective: 1.0 Understand the basic concepts of differential Calculus and in application in solving engineering problems**		
	Specific Learning Outcome	Teachers Activities	Resources
1 – 4	1.1 Define limits with examples 1.2 State and prove basic theorems on limits 1.3 Prove that lim sin θ/θ, lim Tan θ/θ = 1 as θ60 1.4 Define differentiation as an incremental notation or a function. 1.5 Differentiate a function from first principles. 1.6 Prove the formulae for derivative of functions, Function of a function, products, and quotient of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. 1.8 Derive second derivative of a function. 1.9 Apply differentiation to simple engineering and technological problems. 1.10 Explain the rate of change of a function 1.11 Explain the condition for turning point of a function. 1.12 Distinguish between maximum and minimum value of a function. 1.13 Sketch the graph of a function showing its maximum and minimum points and points of inflexion. 1.14 Estimate error quantities from the small increment of a function. 1.15 Determine the tangent to a curve. 1.16 Determine the normal to a curve.	Teachers are to give and solve simple engineering and technological problems	**Chalkboard, textbooks, lecture notes, chalk**
	General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems		
	2.1 Define integration as the reverse of differentiation. 2.2 Explain integration as a limit of summation of a function. 2.3 Distinguish between indefinite and definite integrals. 2.4 Determine the indefinite and definite integrals.	Ask students to apply integral calculus to simple function	-do-

5 – 8	2.5 Determine the definite integral of a function. 2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions. 2.7 List possible methods of integration. 2.8 Integrate algebraic and trigonometric functions by the substitution method 2.9 Integrate trigonometric and exponential functions by parts 2.10 Integrate algebraic functions by partial fraction. 2.11 Integrate trigonometric and logarithmic functions applying reduction formula. 2.12 State standard forms of some basic integrals. 2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, center of gravity, center of surface area, second moment and moment of inertia. 2.14 Define Trapezoidal and Simpson=s rule as methods of approximating areas under given curves. 2.15 Find approximate area under a curve applying Trapezoidal method. 2.16 Find approximate area under a curve applying Simpson=s rule. 2.17 Compare result obtained from Trapezoidal and Simpson=s rules with the results by direct integration. 2.18 Apply integration to kinematics.		
	General Objective 3.0: Understand first order homogenous linear ordinary equations with constant coefficients as applied to simple engineering problems		
9 - 12	3.1 Define first order differential equation 3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations. 3.3 List examples of various types of first order differential equations. 3.4 Define first order homogenous differential equations 3.5 List the methods of solving differential equations by separable variables. 3.6 Identify differential equations reducible to the homogenous form. 3.7 Explain exact differential equations. 3.8 Solve exact differential equations, e.g.	Ask students to apply differential equation to solve engineering problems	-do-

	Show that $(3x^2 + y \cos x)\, dx + (\sin x - 4y^3)\, dy = O$ is an exact differential equation; Find its general solution. 3.9 Define integrating factors. 3.10 Determine the solution of differential equations using integrating factors. 3.11 Define linear differential equations of the first order.		
	General Objective 4.0: Understand the basic concepts of partial differentiation and apply same to engineering problems		
13 - 15	4.1 Define partial differentiation 4.2 List and explain the uses of partial derivatives. 4.3 Solve problems on partial differentiation. e.g. $f(x, y) = x^2 + y^2 = 2xy$, find dy/dx, dx/dy 4.4 Apply partial differentiation to engineering problems.	Solve problems on partial differential	-do-

Assessment: The continuous assessment, test and quizzes will be awarded 40% of the total score. The end of the semester Examination will make up for the remaining 60% of the score

PROGRAMME: NATIONAL DIPLOMA IN CIVIL ENGINEERING			
COURSE: INTRODUCTION TO STATISTICS		**COURSE CODE: STA 111**	**CONTACT HOURS: 1-1-0**
Course Specification: Theoretical Contents			
WEEK	**Special Learning Outcomes**	**Teachers Activities**	**Resources**
	General objectives 1.0: Understand statistics and all that it stands for.		
1	1.1 Define statistics 1.2 Explain with approximate illustrations, the use of statistics in Government, Biological Sciences, Physical Science. Business and Economics.	Lecture Give students assignments	Chalkboard, chalk, duster, calculators. Recommended text books
2-3	**General Objective 2.0: Understand the different methods of data collection and their limitations.**		
	2.1 State the method of collecting data 2.2 Describe the two main methods of collecting primary data: a) Established published sources b) "Ad-hoc" basic or experimentation 2.3 State the merits and demerits of the methods of collecting primary data 2.4 Explain the concept of data "editing" and its application in editing primary and secondary data. 2.5 Describe the sources of error in data collection	- do -	- do -
	General Objectives 3.0: Know the different forms of data presentation		
4-5	3.1 Explain the objectives of classification of a mass of raw data 3.2 Prepare a frequency distribution form a given data 3.3 Explain the usefulness of diagrams in presenting statistical data 3.4 Construct bar chart, pie chart, histogram, frequency	Lecture Give sample charts Give students assignments	- do -

	polygon and cumulative frequency polygon knave for a given set of data 3.5 Outline the merits and demerits of each diagram in 3.4 above.		
	General Objective 4.0 Understand the use and the importance of some measures of central tendency in summarizing data.		
6-7	4.1 Define Arithmetic mean, Geometric Mean, Median, Mode and harmonic mean 4.2 Compute the measurer in 4.1 above given: i. ungrouped ii. grouped data 4.3 Explain the uses of Geometric and Germanic means 4.4 Calculate: Quantiles Deciles Percentiles given a set of data List the merits and demerits of all the above measured of central tendency.	Lecture Give students assignments	- do -
	General Objective 5.0: Understand the use and importance of measures of dispersion in summarizing data		
8	5.1 State the importance of measures of dispersion 5.2 Defined and calculate the mean deviation Semi interquartile range Variance and standard 5.3 Describe the application of the measures of dispersion defined in 5.2 above. 5.4 Calculate these standard error of the sample mean for given data	- do -	- do -
	General Objective: 6.0 Know the different types of random variables		
9	6.1 Define a random variable 6.2 Explain the concept of randomness 6.3 Define discrete and continuous variables	- do -	- do -

	6.4 State examples of discrete and continuous variables		
	General Objective 7.0: Understand the basic principles of probability		
10	7.1 Define probability 7.2 Explain probability using the relative frequency approach 7.3 State the laws of probability 7.4 Solve simple problems by applying the laws of probability 7.5 Define conditional probability for two events.	- do -	- do -
	General Objectives 8.0: Understand some basic probability distributions and be label to identify each distribution		
11-13	8.1 State the probability distribution of a random variable 8.2 Define mathematical expectation of discrete and continuous random variable 8.3 Define expectations of functions of discrete random variable 8.4 Define the binomial distribution 8.5 Define conditional probability for two events 8.6 Calculate the means and variance under the Binomial and the poison distributions 8.7 Define Normal distribution 8.8 Approximate probabilities for given continuous random variables using normal distribution 8.9 Explain the characteristics of Binomial distribution 8.10 Apply Binomial distribution of samples with replacement 8.11 Solve given problems applying binomial distribution 8.12 Describe normal distribution curve and the empirical distribution rule 8.13 Explain the characteristics of Normal distribution Calculate the probability given the deviation from the mean	- do -	- do -

	8.14 Calculate the deviation given the means, standard deviation and a particular observation 8.15 Calculate the area under the curve at different point from either side of the mean. 8.16 Apply Normal distribution curve to simple problems		
	General Objectives 9.0: Understand the principles of correlation of two variables and the regression of one variable on an.		
14 - 15	9.1 Define correlation 9.2 State the types of correlation 9.3 Describe the methods of studying correlation i. Scatter diagram (graphic method) ii. Kari Pearson's coefficient of correlation iii. Spearman's rank correlation 9.4 Calculate Pearson's and Spearman's correlation coefficients 9.5 Define regression equation of the form Y=a+bx using free-hand method and Method of least squares.	Lecture Give sample Charts Give students assignments	- d0 -

ASSESSMENT: Course Work 20%, Course Test 20%, Practical 0%, Examination 60%
COMPETENCY: The Student should be able to apply basic statistical methods in the construction industry.

TRIGONOMETRY AND ANALYTICAL GEOMETRY MTH 122

General Objectives

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

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

COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY COURSE CODE: MTH 122 CONTACT HOUR: 2/0/0			
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the manipulation of trigonometric equations**		
	Specific Learning Outcome:	Teachers Activities	Resources
1 - 3	1.1 Convert sums and differences of trigonometric ratios to products: $\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ $\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ 1.2 Prove the sine and cosine formulae of triangles 1.3 Solve triangles using the sine and cosine formulae e.g.:- The sides a,b,c, of a triangle are 4cm, 5cm, and 6cm respectively. Find the angles. 1.4 Calculate angles of elevation and depression using trigonometric ratios e.g.:- From the top of a tree 120m high an observer sees a boat 560m away. Calculate the angle of depression. 1.5 Compute bearings, heights and distances of inaccessible objects and projections, e.g. B A man walks 3km due N, and the 3km N.52^o W. How far is the of his starting point? What is his bearing from his original position. 1.6 Derive half angle formulae fro sin, cos and tan. 1.7 Define inverse circular function. 1.8 Explain inverse circular functions graphically. 1.9 Solve problems involving 1.8 and e.g.:- Draw the graph of 1/(cos 2θ Taking values from Q^o to 90^o inclusive. 1.10 Apply the concepts in 1.8 above to three dimensional problems.	Illustrate with good examples activities in 1.1 to 1.10 and ask the students to solve problems on them. Assess the student	Recommended textbooks, lecture notes, chalkboard, chalk, etc
	General Objective 2.0: Understand the concept of mensuration and its application to engineering problems		
	2.1 Explain circular measure 2.2 State the relation between radians and degrees 2.3 Prove the formulae for arc length and area of a sector. 2.4 Identify segment and chord of a circle. Determine the area of a segment and the chord of length of a given circle.		

4 - 5	Calculate the surface areas and volumes of simples shapes such as cylinder, sphere and cone. E.g. A solid sphere has radius 8cm. Calculate its volume. 2.7 Determine the areas and volumes of irregular shapes applying Simpsons rule. 2.8 Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.		
	General Objective 3.0: Understand the concept of analytical geometry and their applications		
6 - 9	3.1 Explain two dimensional coordinate systems: Cartesian and Polar-coordinate systems. 3.2 Explain plotting and sketching of graphs w.r.t. the two coordinate systems. 3.3 Relate Cartesian coordinate to polar coordinates. 3.4 Explain the slope of a line in relation to the above concepts in 3.3. above. 3.5 Explain the intercept of a line. 3.6 Derive the formula for the gradient of line passing through two points. 3.7 Derive the equation of a straight line given the gradient and the co-ordinates of a point. 3.8 Reduce a given linear equation to the intercept form. $x/a + y/b = 1$ 3.9 Determine the coordinates of the point of intersection of two straight lines. 3.10 Define locus 3.11 Derive the slope-intercept form of the equation of a straight line: $y = mx+c$ 3.12 Derive the point B slope form of the equation of a straight line: $y - y_1 = m(x - x_1)$ 3.13 Derive the double B point form of the equations of the straight line: $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$ 3.14 Derive the perpendicular form of the equation of a straight line	□ Illustrate the activities in 3.1 to 3.20 with good examples and ask the students to solve problems on them. □ Assess the students	□ Lecture notes, recommended textbooks, chalkboards, chalk, duster etc.

	3.15 Solve examples of 3.11 to 3.14 above. 3.16 Find the angle (Q) between two lines whose slopes, (m_1, and m_2) are Known: $Q = \tan (m_2 B m_1)/1 + m_1 m_2$ 3.17 Determine the conditions for two lines to be parallel and to be perpendicular. 3.18 Derive the expression for the perpendicular distance from a point to a line. 3.19 Draw a circle. 3.20 Derive the equation of a circle with center at the origin and radius r.	□ Illustrate the activities in 3.21 to 3.26 and ask the students to solve problems on them	□ Recommended textbook, lecture notes, chalkboard, chalk etc.
10 - 11	3.21 Derive the equation of a circle with center outside the origin. 3.22 State general equation of a circle. 3.23 Determine the coordinates of the center of a circle from a given equation of a circle. 3.24 Draw orthogonal circles 3.25 Find the equations of the tangent and the normal at a point circle 3.26 List illustrative examples of each of 3.20 to 3.25 above		
12 - 15	4.1 Define the Parabola 4.2 Derive the standard equation of a Parabola $y^2 = 4ax$ 4.3 State the properties of the parabola 4.4 Define the focal chord, axis and lotus rectum of the parabola 4.5 Determine the equation of the tangent and normal from a given point to the parabola. 4.6 Solve problems on parabola e.g. Write down the equation of the parabola and state its vertex if the focus B is (2,0) and the directex x = - 2. 4.7 Define and ellipse 4.8 Derive the equation of an ellipse $x^2/G^2 + y^2/b^2 = 1$ 4.9 State the properties of the ellipse 4.10 Determine the equation of the tangent and the normal to an ellipse from a given point. 4.11 Define focal chord and axes of ellipse. 4.12 Solve problems on ellipses e.g. Find the length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$ 4.13 Define the Hyperbola		

	4.14 Derive the equation of the Hyperbola 4.15 Identify the properties of the Hyperbola. 4.16 Define asymptotes, chord, tangent and normal to a hyperbola.4.17Solve problems on hyperbola e.g. Find the foci and directrices for hyperbola: $x^2/16$ B $y^2/9 = 1$ 4.18 Explain rectangular hyperbola 4.19 Determine tangent and normal to the rectangular hyperbola.		

Assessment: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score

SURVEYING AND GEOINFORMATICS

PROGRAMME: NATIONAL DIPLOMA IN CIVIL ENGINEERING			
Course: Basic Principles in Surveying I	**Course Code: SUG 101**	**Contact Hours: 1 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understanding the Basic Principles and Scope of Surveying and Geo-informatics**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Explain the principle of working from 'whole to part' in Survey/Geo-data works. 1.2 State the importance of "scientific honesty" made on observations. 1.3 Explain with examples the various "checks" made on field observations and during computation. 1.4 Define errors or misclosure in surveys and describe methods of "balancing" these. 1.5 Explain the need and procedure for "examination" of surveys and Geo-data. 1.6 Describe the various classes of survey/Geo-data and their order of accuracy. 1.7 Explain the principles of 'economy of accuracy' and its influence on choice of equipment and methods.	▪ Lecture, give examples of various classes of survey as used in civil engineering.	▪ Field books ▪ tables
2	1.8 Explain the principles of 'consistency' in surveys/Geo-data. 1.9 Distinguish between accuracy and precision. 1.10 Describe the procedure of entrusting 'custody' of survey/Geo-data monuments to local officials and the instructions for their 'preservation'. 1.11 Name the different branches of surveying and Geo-informatics stating their aims e.g geodetic survey topographic survey, cadastral survey, hydrographic survey, engineering and large scale surveys.	- do -	
	General Objective 2.0: Understand the use and methods of using Linen and steel tapes in making linear measurements		
3	2.1 Explain the effect of (a) misalignment (b) slope (c) temperature (d) tension and (e) standardisation error on measured distances. 2.2 Apply the corrections listed in 2.1 above. 2.3 Identify chain surveying instruments e.g. Linen tapes, steel tapes, ranging rods. 2.4 State the necessary precautions in the use of the above instruments. 2.5 State the criteria for selection of survey lines and offsets and the	Lecture, examples of calculation for corrections to be given.	Tapes, chains, and ranging rods.

	limitations on lengths.		
	2.6 Describe the methods of making linear measurements in chain surveys - both along the survey line and along offsets . 2.7 State limiting conditions on measurement accuracy on 2.6 above. 2.8 Explain common errors in chain surveying and their sources - e.g. squaring of building corners, wrong booking of values.		
5	2.9 Explain with sketches the basic methods of check or proof lines, the use of control frame work for position and orientation. 2.10 Describe the general procedure for carrying out a chain survey. 2.11 Illustrate the method of booking field measurements in chain surveys. 2.12 Enumerate field problems and methods of overcoming them. 2.13 Identify errors in simple chain surveys. 2.14 Carry out survey of an area of at least one hectare 2.15 Book all field measurements. 2.16 Plot survey at a suitable scale 2.17 Draw to field standards using conventional signs and hand lettering.		
6	**General Objective 3.0: Understanding the principles of measurement of angles with theodolites and bearings with a magnetic compass and perform such measurement**		
	3.1 Describe the basic principles of ordinary spirit levelling and digital spirit levelling. 3.2 List the specifications of tertiary levelling. 3.3 Explain the (optimum) observing procedure.	▪ Lecture	▪ Compass, theodolite, targets.
7	3.4 Describe the use of and criteria for selections of levelling datums. 3.5 Adjust collimation error in level. 3.6 Describe the construction and use of semi-permanent and permanent tertiary bench-marks. 3.7 Book field observations.	Ditto	Ditto
8	3.8 Reduce level. 3.9 Explain arithmetical checks in level reduction. 3.10 Carry out tertiary levelling, reduction and adjustment to produce elevations of all permanent stations along a circuit of about 2km, using ordinary and digital levels. 4.11 Enumerate the uses of tertiary levelling.	Ditto	Ditto

	General Objective 4.0: Tertiary Levelling		
9	4.1 Describe the various units of angular measure e.g degrees grads and radian measures, working out their convertion factors. 4.2 Explain the working principles of a surveyors' (Prismatic) compass. 4.3 Describe the procedure of observation with a surveyors' (Prismatic) compass.	▪ Lecture, give examples of reduction of levels to National datum.	▪ Levels of various types, staff.
10	4.4 Explain the method of observation with a theodolite. 4.5 Explain the difference in the reading procedure of a theodolites 4.6 Carry out angular measurements with prismatic compass and theodolites.	Ditto	Ditto
	General Objective 5.0: Understand the principles of survey computations and plotting.		
11	5.1 Reduce the measured field data with a theodolite to obtain required angles. 5.2 Deduce bearings from the obtained angles. 5.3 Adjust compass bearings of the compass surveyed area. 5.4 Carryout the computation of 5.3 above. 5.5 Retrieve the measured field data of the surveyed area by a total station onto a PC. 5.6 Process the data using the PC. 5.7 Plot the plan of the surveyed area manually at different scales (small, medium and large)	▪ Lecture, give examples of computations.	▪ Calculators, computer.
	General Objective 6.0: Read, interpret make measurement from maps, layout and engineering plan.		
12	6.1 State the uses of different types of map e.g atlas, geographical, topographical, engineering and guide maps. 6.2 Explain the principles of map scale. 6.3 State the relationships between map scales or representative fractions and the contour interval. 6.4 Identify map symbols and conventional signs. 6.5 Explain their basis and use. 6.6 Identify various Nigerian map series. 6.7 Use map catalogues . 6.8 Describe various methods of showing relief on maps e.g spot heights, hachures, contours.	▪ Lecture, ▪ Give students maps and examples to work on.	▪ Examples of various types of maps to students to examine.
	6.9 Define map grids. 6.10 State the uses of map grids. 6.11 Explain how to establish different reference directions e.g true north, grid north and magnetic north. 6.12 Define the relationship between the different directions i.e convergence, declination and compass variation.	▪	▪ Set of maps for student exercises. ▪ Drawing instruments, protractors dividers, Parallel rule, Scale

13	6.13 6.14 6.15 6.16 6.17 6.18 6.19	Scale off grid coordinates. Interpret different types of map, layout plans and diagrams/sketches. Identify simple planimetric details on imageries. Measure distances from maps and plans. Determine radius of curves from given diagram. Read off directions/bearing between given features. Describe different map reference system.		rules

Revision 2 Weeks

References: Survey for Engineers (1994) Uran J and Price WF MacMillian Site Surveying (1993) Muskett J., Blackwell..

Assessment Coursework 20% course tests 20% Practicals 20% Examination 40%,

Competency: The student completing this unit should be proficient at measuring distances, and in undertaking a chain survey. The student should also be familiar with leveling techniques be able to reduce the data and plot profiles of levels.
The student should be able to use a theodolite for measuring and setting out angles, undertake associated calculations and read maps accurately.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Basic Principles of Surveying I	**Course Code: SUG 101**	**Contact Hours: 1 – 0 –3**	
Course Specification: Practical Content			
WEEK	**General Objective: To Introduce the Students to Basic Principles and Methods in Surveying**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1-2	Range out a straight line (a) between two - intervisible points, (b) between two points that are not intervisible.	Demonstrate and supervise ranging using ranging poles and total stations.	Total station, target. Line, ranging poles, linen tape, chain.
3-4	Carry out liner measurement with tape.	Supervise the art of measuring using tapes.	Ditto
5-6	Carry out chain surveying exercise of a section of the institution.	Organise chain surveying procedure.	Chain, tapes, ranging poles.
9-11	Carry out levelling exercises in the school of Environmental Studies and Engineering.	Supervise levelling procedure. Directs students to prepare drawing sheets for profiling.	Engineer level, staff. Computer, target.
12-15	Carry out a profile levelling of all major roads and isles of the institution and plotting the longitudinal sections and cross-sections of the profiles. Measure horizontal angles and vertical angles with a theodolite. Set on 90^{o} and other angles with the theodolite.	Demonstrates setting up theodolite over a peg and explain the correct procedure to measure angles.	Digital level, ranging poles, linel tapes drawing paper, pencil eraser. 20'' theodolite, tripods targets, ranging rods peg.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Basic Principles in Surveying II	**Course Code: SUG 102, Prerequisite SUG 101**		**Contact Hours 1 – 0 – 3**
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the principle in Distance Management**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Observe small vertical angles precisely by repetition. 1.2 Determine horizontal distance using vertical stage and tacheometer.	Lecture, with examples.	Engineer's level Field book
2	1.3 Explain the special characteristics and use of self reducing tacheometers.	Ditto	Ditto
3	1.4 Measure distances using a theodolites as tacheometer. 1.5 Determine spot-heights and survey detail by tacheometry.	Ditto	Ditto
	General Objective 2.0: Understand the procedure and methods of third order theodolite and total station traversing.		
4	2.1 Identify the various items of equipment used in theodolite and total station traversing. 2.2 List specifications for measurement of angles and distance. 2.3 Determine bearings and tolerable linear and angular misclosures for secondary and tertiary traverses. 2.4 Explain the need for connection to and procedure for verification of existing controls. 2.5 Describe field method of traversing using surface taping. 2.6 Explain the various precautions in field measurements. 2.7 Describe the field checks applicable.	Lecture Worked examples to demonstrate computations.	Theodolite Tapes
5	2.8 Use the force centering equipment explaining special advantage thereof. 2.9 Explain the role of theodolite and total station traversing in provision of control for surveys. 2.10 Carry out traverse using surface taping 2.1. Verify the control to which the survey 2.9 is connected, the surveying of adjacent details (by radiation and intersection), computing the traverse, adjusting distances, bearings and co-ordinates, and producing a	Lecture Worked examples to demonstrate computations	Theodolite Tapes

	plan in ink		
	General Objective: 3.0 Understand the principles, field methods and calculation procedures for minor triangulation		
6	3.1 Explain the basic principles of triangulation. 3.2 Enumerate other parameters of triangulation such as selection, beaconing, numbering of triangulation stations, baseline, azimuth determination, extension of connected triangles, angular repetition, reciprocal observations, angular misclosures, field measurement checks etc.	Ditto	Ditto
7	3.3 Explain methods of computing coordinates and heights from field records.	Ditto	Ditto
	General Objective: 4.0 Understand the basic principles and methods of using total station and GIS Equipment.		
8	4.1 Describe a total station and its accessories. 4.2 Compare total station with a theodolite. 4.3 Explain the working principles of a total station. 4.4 Describe the procedures of observation with a total station. 4.5 Carry out a simple survey using a total station.	Lecture	Total station Targets
9	4.6 Retrieve the measured data from a total station field data on to a PC. 4.7 Process the data from the PC. 4.8 Plot the plan of the surveyed area manually. 4.9 Describe the various types of GPS equipment e.g hand held and tripod types. 4.10Explain the working principles of GPS. 4.11 Carry out GPS observations on selected points.	Ditto	Total station Computer GPS Software
	General Objective: 5.0 Understand problems involved in producing contoured plans.		
10	5.1 Name the different reference directions for contoured plan. 5.2 Explain basic need for heights in topographical Engineering and Township Surveys. 5.3 Illustrate optimum distribution of spot heights for controured plans. 5.4 Describe the use of grids of levels. 5.5 Carry out contouring at 0.5m vertical interval from a mesh of spot heights.	▪ Lecture.	▪ Levels ▪ Theodolite
	General Objective: 6.0 Understand setting in out procedure for a medium sized building including.		
	6.1 Identify the equipment required to set-out a building with accompanying access roads.	▪ Lecture, ▪ Illustrate site practice with	▪ Theodolite/Total ▪ Station

	6.2 Explain how to set-out a building and the accompanying constraints. 6.3 Construct profiles and datum for a building. 6.4 Explain how profiles are used to control. 6.5 Identify the instruments used for taking internal and external dimensions.	slides or photographs.	
12	6.5 Determine the areas of a building and its site. 6.6 Explain how running internal and external measurements are taken horizontally and vertically. 6.7 State the procedure for checking vertically a building using Theodolite, Optical Plumb, and Plumb-bob. 6.8 Describe the invert of a drain, a sight rail and a traveller. 6.9 Calculate suitable length of a traveller and reduced levels of sight rails from given drawings. 6.10 Establish sight rails for horizontal and depth control of a straight drain between manholes.	Ditto	▪ Theodolite ▪ Optical Plumb ▪ Plumb-bob
13	6.11 Explain the survey terms used in road construction. 6.12 Describe methods of route surveying. 6.13 Describe the types of control used for embarkments, cuttings and levels. 6.14 Calculate volumes of cut and fill on a given straight road with transverse sloping ground.	Ditto	▪ Theodolite/total station levels

Revision 2 weeks**.** Revise main topics, give worked examples etc.

References Surveying for Engineers (1994) Uren J Macmillan and Price WF, Setting Out Procedures (1998) Sonlorove BM Butherworth Heineman.

Assessment: Coursework 20% Course tests 20% Practical 20% Examination 40%.

Competency: The student who completes this unit should be proficient in using levels and theodolites, capable of undertaking simple surveys and be able to set out buildings with confidence.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Basic Principles of Surveying II	**Course Code: SUG 102**	**Contact Hours: 1 -0 - 3**	
Course Specification: Practical Content			
WEEK	**General Objective: The use of levels, theodolites and total station in measurement of, bearings, highting, and triangulation and plan production.**		
	Specific Learning Outcome:	**Teachers Activities**	**Resources**
1 - 4	1. Carry out campass traversing of a closed figure, produce the plan and make graphical adjustment.	▪ Demonstrate compass traversing and direct the student to produce plan.	▪ Compass, drawing paper, scales, pencil, rules, eraser.
5 - 7	2. Carry out theodolite traversing of the roads surrounding the school of engineering. Compute and plot the traverse.	▪ Supervise the use of traversing. ▪ Direct the students to use reduced bearing and distances to plot a traverse.	▪ ▪ Theodolite, total station, targets, poles, drawing
8 - 12	3. Use theodolite along with staff to obtain distances and heights.	▪ Supervise the use of theodolites as in tacheometric surveys .	▪ paper, pencil, eraser. ▪ Theodolite, staff.
12-14	4. Determine spot levels and survey detail by tacheometer working out accuracies attainable in various methods of optical distance measurements. Plots datum to scale and prepares a contour drawing. 5. Carry out tertiary levelling, reduction and adjustment to produce elevations of all permanent stations along a circuit of about 5kms. 56. Undertake a service of setting out exercises, e.g. for a small building.	▪ Demonstrate the procedure for tertiary levelling along a circuit.	▪ ▪ Levels, pegs, tape. ▪ Theodolite staff.

PROGRAMME: CIVIL ENGINEERING			
Course: Engineering Surveying I	**Course Code: SUG 208**	**Contact Hours: 1 – 0 - 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the basic principles and scope of engineering surveying.**		
	Specific Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 List the types and scales of plans required for constructions. 1.2 Describe the general procedure of setting out engineering works. 1.3 Describe the general procedure of "as built" surveys. 1.4 List the methods of surveying for construction. 1.5 State examples of engineering surveys where photogrammetry may be used. 1.6 Apply the uses of modern computational methods in engineering surveys. 1.7 Apply the uses of modern survey instruments in engineering surveys.	▪ Lecture	▪ Chalkboard ▪ OHP ▪ Charts ▪ Picture ▪ Video ▪ Maps
	General Objective 2.0: Understand the basic principles of geometric design of routes.		
2	2.1 List the types and scales of plans required for route design. 2.2 Identify the geometrical elements of routes especially roads. 2.3 Distinguish between geometric design requirements of roads, railways, pipelines, electric power lines, etc.	Ditto	▪ Maps ▪ Drawings ▪ Pictures
	General Objective 3.0: Know how to set out routes consisting of straight and circular curves		
3	3.1 Describe the process of setting out long straight lines. 3.2 Derive mathematical relationships between circular curve elements. 3.3 Solve the problem of setting out the circular curve if there are obstructions to sighting the deflection angles. 3.4 Run through the chainage in a route comprising straight and circular curves.	▪ Lecture	▪ Total Station ▪ Theodolite
4	3.5 Derive necessary formulae to set out circular curves by deflection angles.	▪ Lecture	- Ditto -
5	3.6 Describe other methods of setting out circular curves. 3.7 Utilise the tabulated deflection angles when occupying successive instrument stations along circular curves. 3.8 Set out a long circular curve by deflection angles using successive instrument stations.	- Ditto -	- Ditto -

	General Objective 4.0: Understand the methods of running, calculating plotting and drawing longitudinal sections and cross sections.		
6	4.1 Describe the basic principles of sectioning. 4.2 Distinguish between longitudinal sections and cross sections. 4.3 Range and set out cross sections. 4.4 Describe the methods of leveling the longitudinal section. 4.5 Illustrate methods of booking sectional observation. 4.6 Reduce the levels of all points and plot longitudinal section and cross sections. 4.7 Explain the essential difference between the plot of longitudinal section and cross section. 4.8 Explain why in practice cross sections are usually taken at intervals.	- Ditto -	▪ Digital levels ▪ Engineer's level
7	4.9 Carry out ranging, leveling, calculation, plotting and drawing of longitudinal section and cross sections at 30m intervals of a proposed road alignment.	▪ Lecture with examples.	- Ditto -
	General Objective 5.0: Understand methods of area computations		
8	5.1 Distinguish between rectilinear and irregular areas. 5.2 Describe the methods of obtaining the area using formulae for geometric figures. 5.3 Use the planimeter.	▪ Lecture	▪ Planimeter
9	5.4 Calculate areas by the trapezoidal and by Smpson's rules. 5.5 Compare the methods of area calculations.	▪ Lecture with examples	- Ditto -
	General Objective 6.0: Understand methods of volumes computations.		
10	6.1 Explain the need for calculation of volumes of earthworks. 6.2 Derive the trapezoidal and prismoidal formulae.	▪ Lecture	- Ditto -
11	6.3 Calculate volumes from 6.2 above. 6.4 Calculate volumes from contour lines. 6.5 Calculate volumes from spot heights.	▪ Lecture, give examples.	- Ditto -
12	**General Objective 7.0: Understand the process of setting out structures.** 7.1 Explain how setting out differs from ordinary surveying. 7.2 Describe the forms of horizontal and vertical controls needed by the setting out process. 7.3 Determine plans required for setting out. 7.4 Describe all the stages of setting out engineering structures. 7.5 Set out buildings.	Ditto	▪ Total Station ▪ Digital theodolite

	General Objective 8.0: Understand the specialized aspects of "as built" surveys.		
13	8.1 Explain the need for "as built" surveys. 8.2 Identify the requirements of as "built" surveys. 8.3 Carry out the methods of surveying for existing and new works as finally constructed.	Ditto	- Ditto -

Revision Week 14 & 15
References Engineering Surveying (1993) Schotiell, Poultarwrith-Heimm.
Assessment: Coursework 20%, Course test 20%, Practical 20%, Examination 40%.
Competency: The student should be able to undertake minor engineering surveys and complete all necessary calculations.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Engineering Surveying I	**Course Code: SUG 208**	**Contact Hours: 1 – 0 - 3**	
Course Specification: Practical Content			
WEEK	**General Objective: To reinforce the use of Survey Equipment in carry out Tacheometric surveys, plan production, computation of areas and volumes and mass haul diagrams.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1-4 5 – 6	1. Carryout ranging, leveling, calculations, plotting and draw longitudinal and cross-sections at 30m internal of a proposed road alignments. 2. Carry out simple circle ranging.		
7 – 8	3. Carry out Tacheometric Survey of the School of Engineering.	▪ Demonstrate the procedure for tacheometric survey.	▪ Theodolite, staff, total station.
9 –10	4. Produce contoured plan using, theodolite along with levelling staff level with tape and staff.	▪ Demonstrate the use of theodolite in obtaining heights. ▪ Ditto using levels.	▪ Drawing paper, Pencil, Eraser. ▪ Theodolite, level, tapes, staff.
11-12	5. Carry out area computation of the School of Engineering with regular boundaries.	▪ Divide area into grids of equal width. Use area method to explain the calculation using simpson, rule, and other methods including the planimeter.	▪ ▪ Planimeter, drawing paper, Pencil, eraser. ▪ Calculators.
13-15	6. Carry out volume computation of earth works with cut and fill and draw mass haul diagram.	▪ Lecturer to provide data from a survey. ▪ Demonstrate how to obtain areas of cut and fill from cross-section. Explain have volumes are obtained by multiplying by depth. Explain how mass haul diagrams are produced. ▪ Give assignments with above. ▪ Demonstrate the arrangement and alignment of aerial photographs to obtain a centre line of a new road.	▪

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Elements of Geo-Informatics	**Course Code: GIT 201**	**Contact Hours: 1 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the general concept of Geo-informatics**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 Define Geo-Informatics, map, digital mapping, map databases etc. 1.2 Explain the basic concepts of Geo-Informatic. 1.3 Explain the basic principles of digital mapping. 1.4 List the different types of digital data. 1.5 State the accuracy of each type of data.	▪ Lecture	▪ Charts ▪ Maps ▪ Pictures ▪ OHP ▪ Video
	General Objective 2.0: Know the hardware and sorftware for requirements for Geo-Informatics		
2	2.1 Mention the various components of hardwares for Geo-Informatics. 2.1 Explain the memory capacity required (such as RAM – 32 Mb or higher, harddisk of 1.2 ab or higher, speed of 200 MHz or higher SUGA VRAM – IMB or greater, 24 x CD drive, 3.5 drive of 1.44 Mb, etc).	▪ Lecture, demonstrate use of programme	▪ Computers with suitable programmes.
3	2.2 Mention the various geo-informatics software e.g. CAD-Auto card, GIS Vector-MAP INFO, GIS Raster, DIP, view (windows base) etc.	Ditto	Ditto
	General Objective 3.0: Understand the various sources of data for geo-informatics.		
4	3.1 Mention different types of map (e.g topographic, thematic, digital, etc). 3.2 Mention different types of images (e.g aerial, satellite, radar, scanned aerial photos, etc).	Ditto	▪ Computers with suitable programme.
5	3.3 Explain the different types of observed data (e.g theodolite, GPS, Total station, levels, hydro-phones, geo-phones, statistical etc). 3.4 Enumerate historical sources of data (e.g cadastral, history, archeological, natural resources, etc).	Ditto	Ditto
6	**General Objective 4.0: Understand the methods of data acquisition for data base creation.**		
	4.1 List the various methods of data acquisition (e.g. aerial, satellite, surveying, digitalization scanning, radar, statistical survey, etc).	▪ Lecture demonstrate, use of programme	▪ Computers with suitable ▪ Programme
7	4.2 Explain the procedures of 4.1 above. 4.3 Outline the specification and limitations of 4.1 above for geo-informatics requirements.	Ditto	Ditto

8	4.4 Describe the data structure and format of 4.1 above. 4.5 Explain data conversion processes. 4.6 Enumerate the procedure of data base management.	Ditto	Ditto
	General Objective 5.0: Understand the areas of application of geo-informatics.		
9 - 10	5.1 Mention the various areas of application of geo-informatics (e.g map revision, environmental monitoring and assessment, natural resources management, defence and security, utilities planning, engineering, population, forestry, Agriculture, Transport and Aviation, Petroleum Resources, health, education, sports development, finance, archeology etc).	Ditto	▪ Computers with suitable programme
11	5.2 Relate each of the above application to national development. 5.3 Discuss the means of achieving the above applications in Nigeria.	Ditto	Ditto
12	5.4 Enumerate if any, the obstacles that could hinder the achievement of the application of geo-informatics in Nigeria. 5.5 Explain the role of geo-informatics experts in the society.	Ditto	Ditto

Revisions: weeks 13 - 15

References:
1. Hofinan, W.B., Lichtendgger, H. and Collins, J. "GPS Theory and Practice", Spring Verlag, N.Y. 1993.
2. Maginie, D.J., Good child M.F. 10 and Rhind, D.W. "Geographical Information Systems, Vol. 2: Applications, Longman, 1991.

Assessment: Coursework 10%, Course test 10%, Practicals 40%, Examination 40%

Competency: The students shall have a working knowledge of geo-informatic and application to engineering projects.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Elements of Geo-Informatics	**Course Code: GIT 201**		**Contact Hours: 1 – 0 – 3**
Course Specification: Practical Content			
WEEK	**General Objective: Understand the general concept of Geo-informatics**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1- 15	1. Draw and label hardware 2. List software and use 3. Digitize and correct maps of various scales 4. Scan maps of various scales 5. Produce maps, drawings and data with GIS software	▪ Technologist to assist students on selecting of equipment and uses. ▪ Give assignments	▪ Computers ▪ Total station ▪ GIS, remote sensing ▪ Radar, digital photogrammetry equipment software, ILWIS Auto CADD, GIS vector, and rastar, map-info ▪ Map-Maker, DIP ▪ Arc-View, Arc-Info (Windows base) etc

INFORMATION & COMMUNICATION TECHNOLOGY(ICT)

PROGRAMME: Civil Engineering Technology			
Course: Introduction to Computing	**Course Code: ICT 101**	**Contact Hours: 0/0/3**	
Course Objectives: To give the students the skill needed to appreciate the use of computers and us specialist software Packages in a competent manner, within their own engineering specialty. The learning methodology should be student centred, with the student using various available packages in order to be competent when using them. The use of student workbooks or guided learning materials is recommended.			
Key Objectives: The outcome from the learning process should be that the student would be able to do the following.			
Week	**Specific Learning Outcome**	**Teachers**	**Resource**
1	Define what is meant by a computer. Know the history of computer development (briefly) State the uses of computers and understand the impact of the PC on computer technology. Differentiate between hardware and software Understand the input-process-output algorithm (hardware) a. Central processor b. Input mechanisms c. Output mechanisms	▪ Define what is meant by a ▪ Computer? ▪ Teach the history of Com- ▪ puters developments. (Briefly) ▪ Teach the uses of computers ▪ and the impact of PC on the ▪ society: home, office, ▪ banks etc.	▪ Maximum of 4 students to 1 computer ▪ Maximum of 4 computers to a printer except when a Net work is in use. ▪ 1 Ream of A4 papers to 10 students. ▪ 4 Ink cartridge per printer per semester.
2	Know how data is stored a. RAM b. ROM c. Fixed discs d. Removable discs Understand the concept of an operating system a. PC-DOS/MS-DOS b. Windows c. Linux d. Unix	Explain the need for data storage. Dismantle a computer system and show the students the RAM card, the Hard Disk and the Processors. Explain the concept of an operating system.	
3	**Access computers correctly through Windows operating system.** a. Open/Close a window b. Program Manager c. Button bars/scroll bars/menu bars d. Moving from one window to another	Discuss the advantage of the Windows Operating System. Explain the windows menu and tools. Each student must be given an opportunity to start a computer, open/close the window operating system, understand the program	

		manager and move around in the windows environment.	
4	**Understand file management and how to manage files** a. Creating a file and folder b. Manipulating files (moving, copying, saving, deleting) c. Print manager	Explain the process of creating a file, manipulating the file and use of the print manager.	
	Understand the concept of a software package a. MS Office b. Lotus Smartsuite c. MS Encarta	Load MS Office with the students and explain the various packages that make up MS Office. Load MS Encarta and discuss its use with the students.	
5 - 6	**Demonstrate ability in the competent use of a word-processing package such as MS Word (or equivalent standard)** a. Entering text b. Formatting text (emboldening, font size, italicising) c. Creating and Saving text files d. Editing and moving text e. Importing objects f. Spelling and Grammar Checking g. Creating and manipulating tables, text boxes, equations h. Printing	▪ Demonstrate the installation of MS Words. ▪ Identify the different features of the software. ▪ Ask students to type a short document and save it. ▪ Ask students to edit a document and carry out a spelling check. ▪ Demonstrate the use of tables.	
7 - 8	**Demonstrate ability in the competent use of a graphics package such as Corel Draw (or equivalent standard)** a. Drawing tools b. Text as graphics c. Creating and saving image files d. Editing and moving images e. Importing and exporting graphics f. Windows 'Clipboard' facility g. Creating and manipulating images (re-sizing etc) h. Image file standard (JPEG, PCX, GIF etc) i. Printing	▪ Load Corel Draw. ▪ Explain features of the soft wares. ▪ Demonstrate the creating and saving of images. ▪ Edit the images saved. ▪ Export the graphics to other packages ▪ Demonstrate the manipulation (re-sizing) of images.	
9 - 11	**Demonstrate ability in the competent use of a spreadsheet package such as MS Excel (or equivalent standard).** a. Setting up the worksheet b. Entering data c. Formatting data (decimal places, alpha-numeric)	▪ Load MS Excel . ▪ Explain features of the software. ▪ Create a worksheet and edit it.	

	d. Creating and saving worksheets e. Creating a formula in cells f. Importing objects g. Exporting the worksheet h. Creating and manipulating graphical representations of data i. Printing	▪ Demonstrate how to format a workshop.	
12 - 13	**Demonstrate ability in the competent use of a database package such as MS Access (or equivalent standard)** a. Drawing tools b. Text as graphics c. Creating & saving image files d. Editing & moving images e. Importing & exporting graphics f. Windows 'Clipboard' facility g. Creating & manipulating images (re-sizing etc) h. Image file standards (JPEG, PCX, GIF etc) i. Printing	▪ Load MS Access. ▪ Explain the features and working of the software. ▪ Use students record as example and enter the records in the structure query modify and produce typical report. ▪ Show how to index and sort files in alphabetical order.	
14 - 15	**Use the Internet to retrieve information.** a. World Wide Web (WWW) b. Download information c. Paste retrieved information into an appropriate application d. Use e-mail to send and receive messages. e. National and international e-mail f. E-mail attachments (sending & receiving)	▪ Show students how to look on to the Internet. ▪ Write and send an email. ▪ Surf the net.	

Assessment: Coursework 20%; Course test 20%; Practical 10%; Examination 50%.
Competency: The student should be expose to understand basic computer programming.
Reference: Chapra, S.C. and Canale, R.P. "Introduction to Computing for Civil Enginees, Mcgrew hil, 1994
Press, W.H., Teukolsky, S.A., Vetterling, W.T. and Fannery, B.P. "Numerical recipes". Cambridge Univ. Press, 1993.

PROGRAMME: Civil Engineering Technology			
Course: Introduction to Programming Concepts Using Q-Basic		**Course Code: ICT 102**	**Contact Hours 0/0/2 Practical simultaneously**
Course Specification: Theoretical Content			
WEEK	**General Objective: To enable student to develop basic programming skills**		
	Specific Learning Objective:	**Teachers Activities**	**Resources**
1 – 2	1. Understand Computer Programming a. Define programming b. Define Algorithm c. Outline basic steps in developing algorithm d. Write simple algorithm to solve simple problem e. Explain Flowchart f. Identify Flowchart symbols g. Draw Flowchart of the algorithm in 1.2.2	▪ Define program and give examples ▪ Give real- life example relating to the student's trade e.g Building process, Chair making process ▪ Draw different Flow chart symbols and explain ▪ each ▪ List different programming languages ▪ Give the features of HLL and LLL ▪ Give definitions of translators	▪ Charts
3 4 5 6	2.0 Implement programming concept using BASIC a. State BASIC character set b. State BASIC variable names c. Describe variable name formation d. Form variable names e. Define identifiers f. Classify identifiers e.g string, numeric, real etc 3.0 Define Q-BASIC expressions a. Explain arithmetic expressions b. Explain relational expressions c. Explain logical expressions 4.0 Q-BASIC Functions a. Explain Functions b. Explain in-built functions c. Explain user defined functions 5.0 Q-BASIC syntax a. Explain READ/ DATA Statements b. Explain INPUT Statements c. Explain REMARK Statements	▪ List the basic character ▪ Set e.g Alphabets, digits, ▪ special character ▪ Explain how variable names are formed ▪ Differentiate between identifiers and ▪ variable names ▪ Give examples of arithmetic, relational and logical expressions ▪ Give examples of in-built and user defined functions ▪ Illustrate the use of the different statements with examples	

	d. Explain PRINT Statements		
7-8 9-10	6.0 Introduction to Q-BASIC Environment c. Explain how to enter the Q-BASIC Editor d. Explain how to key in programs e. Explain how to save Q-BASIC programs f. Explain how to debug Q-BASIC program 7. 0 Simple programs c. Write Simple programs d. Run the programs e. Print program result	▪ Get student to switch on to the Q-BASIC ▪ Show the student how to enter theQ-BASIC Environment ▪ Open the Editor ▪ Instruct the student to SAVE, RUN and DEBUG the program ▪ PRINT results	▪ PCs,Q-BASIC Software ▪ Printer
11-12 13-15	8.0 Control Statements a. Explain Control Statements b. Explain Branching statements c. Explain IF-THEN-ELSE d. Explain FOR-NEXT 9.0 Write simple programs using the different statement and constructs	▪ Write program to illustrate the use of IF-THEN-ELSE and FOR-NEXT ▪ Give the student programming projects embracing all concept that have been taught in their ▪ areas of trade	PCs, Q-BASIC Software Printer

Assessment: Coursework 20%; Course test 20%; Practical 10%; Examination 50%.
Competency: The student should be able to use Q-basic to write programs for Civil Engineering works.

PROGRAMME: Civil Engineering Technology			
Course: Computer Aided Design and Drafting I	**Course Code: ICT 201**		**Contact Hours: 0/0/3**
Course Objectives: To give students the skills needed to use CADD Soft wares and in Particular Auto CADD in a Competent manner to Produce Drawings and Schedules Appropriate to their Specialty			
WEEK	**General Objective 1.0: Understand the use of Computer in the Design and Drafting Process**		
	Specific Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 Know the advantages and disadvantages of computer in the design process 1.2 Explain the links between CAD and CAM - Understand the Principles of Operation capabilities and system requirements of Auto CADD - Install the Auto CADD software correctly.	▪ Ask students to explain advantages and disadvantages of computer in the design process. ▪ Ask students to explain the links between CAD and CAM	▪ Complete computer sets ▪ 1 Computer to 2 Students ▪ 1 Large Format Printer or Plotters in a Network ▪ 1 Digitizer to 2 Students
2	1.3 Identify the main parts of the screen of Auto CAD 14 or Later Versions 1.4 Explain the functions of the above 1.5 Understand and use the different input methods: Keyboards, mouse, digitizers, and scanners. 1.6 Understand the different coordinate systems 1.7 Demonstrate the use of the HELP Menu in solving problems when using the Package	▪ Ask the students to identify the main parts of the screen of Auto CAD 14 ▪ Ask the students to explain the function of the above. ▪ Ask the students to explain and use the different input methods	▪
3	1.8 Use the OSNAP facility to select options 1.9 Use layer control to change the layers in a drawing 1.10 Use Cartesian and Polar coordinates to draw lines 1.11 Prepare and change the size of the drawing field 1.12 Know how to save drawings on demand and also how to set up the auto-save feature	▪ Ask students to explain differences between Cartesian and polar coordinates systems. ▪ Ask students to demonstrate the above options on the computer screen ▪ Ask students to construct lines at set lengths and angles using above coordinate systems. ▪ Ask students to use snap points to construct lines. ▪ Ask students to explain the use of snap points and ortho –	▪

		commands	
	General Objective 2.0: Understand how to construct simple geometric shapes		
4	2.1 Know how to hatch the shapes drawn and change the hatch pattern and scale 2.2 Explain how to draw circles, ellipses and arcs to given dimensions 2.3 Explain how to construct polygons and squares to given dimensions 2.4 Produce a simple drawing – Drawing 1	▪ Ask the students to hatch the shapes drawn ▪ Ask the students to change the hatch pattern and scale. ▪ Ask the students to draw circles, ellipses and arcs to given dimensions. ▪ Ask the students to construct polygons and squares to given dimensions.	
	General Objective 3.0: Understand the different edit boxes		
5	3.1 Explain the different edit boxes, how to use them and their attributes 3.2 Explain how to select the shapes using edit boxes. 3.3 Use array command to draw both polar and rectangular arrays 3.4 Explain how to use the offset command	▪ Ask students to explain the different edit boxes. ▪ Ask students to use them. ▪ Ask students to explain their attributes. ▪ Ask students to draw both polar and rectangular arrays using array command ▪ Ask students to draw using the offset command.	
	General Objective 4.0: Understand how to use edit commands	▪	
6	4.1 Explain how to use edit commands 4.2 Demonstrate how to move objects accurately using both snap commands and coordinates 4.3 Demonstrate how to copy objects from one position to another accurately using snap and coordinate entry. 4.4 Demonstrate how to erase objects 4.5 Demonstrate how to trim objects 4.6 Demonstrate how to fillet and chamfer angles	▪ Ask students to copy objects from one position to another accurately using snap and coordinate entry. ▪ Ask students to erase objects. ▪ Ask students to trim objects ▪ Ask students to fillet and chamfer angles	
	General Objective 5.0: Understand how to create layers		
7 - 8	5.1 Demonstrate how to create layers. 5.2 Demonstrate how to change colour of layers 5.3 Demonstrate how to change the line types of a layer. 5.4 Demonstrate how to move objects from one layer to another 5.5 Demonstrate how to switch layers on and off 5.6 Understand the use of layers and how they help in the construction and Understanding of a draw	▪ Ask students to create layers ▪ Ask students to change colour of layers ▪ Ask students to change the line type of a layer ▪ Ask students to move objects from one layer to another ▪ Ask students to switch layers on and off	

		▪ Ask students to use layers to construct drawings.	
	General Objective 6.0: Understand how to create linear and aligned dimensions		
9-10 11 12 13 14-15	6.1 Explain how to create linear and alighed dimensions 6.2 Understand how to create angular dimensions 6.3 Demonstrate how to add to tolerances to dimensions 6.4 Demonstrate how to create leader lines. 6.5 Demonstrate how to add single line and multiple line texts to drawings 6.6 Demonstrate how to edit dimensions and text DRAWING EXERCISE – 2 Create the title block for a drawing Write letters and numbers on drawings Draw circles be able to erase parts of lines or circles DRAWING EXERCISE - 3 Produce a simple drawing with correct details in terms of title block ect Select parts of a drawing in order to do further work. Move, Copy and Rotate drawing parts. DRAWING EXERCISE – 4 Produce a full drawing with title blocks from a real engineered object. Show all the views. DRAWING EXERCISE – 5 Produce a fully dimensioned drawing of a component appropriate to the engineering specialty of the department.	▪ Ask students to create linear and aligned dimensions. ▪ Ask students to create angular dimensions ▪ Ask students to add tolerances to dimensions ▪ Ask students to create leader lines. ▪ Ask students to add single line and multiple line text to drawings. ▪ Ask students to edit dimensions and text. ▪ Ask each student to carry out his/her own drawing ▪ Let each student carry out his/her own drawings. ▪ grade each student's drawing ▪ Ask each student to carry out his/her own drawing ▪ Ask each student to carry out a drawing that is specific to his/her department.	

Assessment: Coursework 20%; Course test 20%; Practical 10%; Examination 50%.
Competency: The student should be able to use computer programs to produce Civil Engineering Drawings and Detailing.
Reference: Hardward Eisner, "computer – Aided systems Engineering" Produce – Hall International Editions, 1988.

DRAWING

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Civil Engineering Drawing I	**Course Code: CEC 209**	**Contact Hours: 1 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the drawing office practice.**		
	Specific Learning Outcomes:	**Teachers Activities**	**Resources**
1	1.1 Produce the layout for an engineering office. 1.2 Describe the functions of personnel and equipment in the drawing office.	Lecture, Demonstrate and supervise	Drawing boards and equipment. Paper
	General Objective 2.0: Understand how to create linear and aligned dimensions: 2.0 Know layout of drawing.		
	2.1 Produce information essential for full communication between designer and contractor i.e tile block. 2.2 Describe line drawing layout and pictorial in formation.	- do -	- do -
	General Objective 3.0: Understand building layout orientation		
2	3.1 Define site plan layout and bearings. 3.2 Explain building orientation with respect to sun and wind.	- do -	- do -
	General Objective 4.0: Know the production of Civil Engineering drawings in standard Format		
3 - 4	4.1 Explain the drawing equipment and materials used in Civil Engineering drawing. 4.2 Describe treatment of lettering and drawing pencil and ink.. 4.3 Use scale drawings and survey drawings, in traditional operations code etc. 4.4 Describe conventional methods of indications and representations of architectural and structural detailing in plan, elevation and sections of buildings and building components. 4.5 Explain the principles of perspective projection.	- do -	- do -
	General Objective 5.0: Understand the view of two and three storey buildings with basement in detail.		
5 6	5.1 Draw the plan, elevations and sectional views. 5.2 Draw working details of special features including stairs. 5.3 Draw underground floor building on slope. 5.4 Expose students to interpretation of working drawing.	- do -	- do -

	General Objective 6.0: Understand reinforced concrete structural detailing.		
7 - 15	6.1 Draw a typical reinforced concrete floor plan showing grid notation. 6.2 Draw reinforced concrete structural elements e.g beams, columns, cut the section. 6.3 Draw full reinforced concrete details of structural elements, viz, foundation, columns, beams, slabs, cantilever lintels and stairs. 6.4 Prepare bending schedule of bars in reinforced concrete elements. 6.5 Undertake the detailing of reinforced concrete structural building 6.6 Use CAD to produce the drawing in 6.5 above	- do -	- do -

Revision: 2 weeks
Competency: The student shall be able to prepare and understand engineering drawings, and to use CAD to produce civil engineering drawing with confidence
Assessment: Coursework – 10%; course test – 10%; Practical – 40%; Examination – 40%.
Reference: 1. M.Y.H. Bagsh, "Structural Details in Concrete" Blackwel.
2. R.L. Fullerton "Building Construction in Warm Climate" 2nd Ed. Oxford U.P. Vol. 2, 1983.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Civil Engineering Drawing II	**Course Code: CEC 210**	**Contact Hours: 1 – 0 –3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand drawing detailing of reinforced concrete members.**		
	Specific Learning Outcome:	**Teachers Activities**	**Resources**
1	1.1 Draw reinforced concrete details of retaining walls, precast concrete piles, and pile caps, draft foundation, etc.	▪ Lecture, demonstrate and supervise.	▪ Drawing board and equipment
	General Objective 2.0: Understand steel structural frame members.		
2 3	2.1 Draw details of various steel structural members and their methods of connections. 2.2 Describe drawing office procedure. 2.3 Explain bolted, riveted, and welded joints. 2.4 Distinguish between bolt and nut. 2.5 Explain grillage foundation. 2.6 Draw field riveted and welded joint, bolt and nut and grillage foundation.	- do -	- do -
	General Objective 3.0: Understand sanitary engineering drawing.		
4 5	3.1 Explain codes of practice for pipework and sanitary fittings. 3.2 Explain working drawing and sanitary drainage system. 3.3 Draw a designed layout of water supply to single storey and double storey buildings. 3.4 Interpret representation on standard building plan. 3.5 Draw domestic hot water services and installation. 3.6 Describe soil and waste plumbing.	- do - - do -	- do - - do -
	General Objective 4.0: Understand the details of sanitary engineering facilities.		
6	4.1 Define traps. 4.2 Define manholes and inspection chambers. 4.3 Distinguish between septic tank and soak-away pit.	- do -	- do -
7	4.4 Draw traps, manholes and inspection chambers, septic tank and soak-away pit.	- do -	- do -
	General Objective 5.0: Know air conditioning and duct layout.		
8	5.1 Draw central air-conditioning layout. 5.2 Draw layout of typical duct system.	- do -	- do -
	General Objective 6.0: Understand external work involved in building.		
9	6.1 Draw simple road layout. 6.2 Draw pathways.	- do -	- do -

10	6.3 Draw kerbs boundary wall and fences. 6.4 Draw cross-section of a paved roadway.	- do -	- do -
	General Objective 7.0: Understand the general principle of a canal and irrigation Engineering drawing.		
11	7.1 Draw irrigation canal 7.2 Identify type of channel and canal lining. 7.3 Draw irrigation outlet falls. 7.4 Draw cross-drainage work.	- do -	- do -
	General Objective 8.0: Understand the drawing special stairs.		
12	8.1 Draw curved stair detailing. 8.2 Draw spiral stair detailing.	- do -	- do -

Competency: The student should be able to undertake structural detailing and other Civil Engineering drawings at the end of the Course.
Assessment: Coursework – 10%; Course test – 10%; Practicals – 40%; Examination – 40%.
Reference: R. McMullan, "Environmental Science in Building" 2nd Ed. McMillan, 1989.

CONSTRUCTION

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Civil Engineering Construction I	**Course Code: CEC 105**	**Contact Hours: 2 – 0 2**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the various building components and their functional requirements.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Explain the term building component. 1.2 Enumerate the building components, etc, foundation, floor, wall, ceiling, roof, fenestrations, doors, windows, etc. 1.3 Identify the different functional requirements of building components. 1.4 Sketch these various building components	▪ Draw, Explain, Enumerate, Identify, Sketch.	▪ O/H projector, ▪ Teaching tools.
2	**General Objective 2.0: Understand the preliminaries involved in the construction of building**		
	2.1 List the site activities which precede the actual building construction such as temporary services, roads, materials storage accommodation, site huts, and offices. 2.2 Name factors to be considered in site organisation and layout.	▪ Lecture, demonstrate, supervise field exercise	▪ Teaching tools, Chain/tape, Theodolite, ranging poles, pegs, line.
3	2.3 Describe the process of setting out a building using the following 3.4, 5, method; builders square method, theodolite method. 2.4 Carry out setting out processes for a building.		
4	**General Objective 3.0: Understand the general principles of selecting and preparing sites to receive various types of foundation.**		
	3.1 Explain the methods of excavation. 3.2 List the tools used in manual method of excavation. 3.3 Describe the principal machines used in excavation. 3.4 Explain with sketches the different methods of earthwork support to trenches in different types of soils. 3.5 Define the term foundation. 3.6 Explain the importance of foundation to the building structure. 3.7 State the various types of soils and how they affect choice of foundation. 3.8 Mention various bearing capacity of typical soils. 3.9 Explain the need to estimate tensile and compressive stresses in foundation.	▪ Lecture	▪ Teaching tools, ▪ DPM, Cement, Aggregates.
5	3.10 Describe the different types of foundations and their application. 3.11 Illustrate simple methods of reinforcement in foundations - ground beams, sheet piles, bearing piles and equipment. 3.12 Explain the method s of construction of the various types of		

	foundation. 3.13 Carry out damp-proofing works.		
6	**General Objective 4.0: Understand the principle of damp-proofing in building.** 4.1 Set out foundation works. 4.2 Explain the processes of damp-proofing. 4.3 Enumerate the various damp-proofing materials in use. 4.4 Explain the importance of hard core. 4.5 Explain the use of blinding. 4.6 Use anti-termite treatment in the foundation works	▪ Lecture	▪ Anti-termite (childrex)
7	**General Objective 5.0: Know the different types of floors.** 5.1 State the functions of floors. 5.2 Enumerate the various types of ground floors. 5.3 Explain the methods of constructing the various types of floors. 5.4 Draw the various types of floors. Suspended Floors 5.5 Enumerate the various types of suspended floors. 5.6 Explain the methods of constructing suspended floors. 5.7 Draw the various types of suspended floors. 5.8 State the differences between ground floors and suspended floors.	▪ Lecture	▪ Teaching tools.
8	**General Objective: 6.0 Understand masonry wall construction.** 6.1 State the functions of walls. 6.2 List the various types of walls in use, e.g. load bearing, non-load bearing, bracing etc. 6.3 Explain with drawings the methods of constructing these various types of walls.	▪ Lecture, demonstrate, supervise.	▪ Plywood, timber, cement, brick, sand.
9	6.4 Enumerate the materials used in wall construction. 6.5 Illustrate with drawings the various types of bonds used in brick and blockwall construction. 6.6 Build brickwalls in a chosen bond.		
10	6.7 Define partition walling 6.8 State the functions of partition walls. 6.9 Enumerate the various types of partition walls. 6.10 Illustrate with sketches how partition walls are constructed. 6.11 Explain the merits and demerits of the various types of partition walls. 6.12 Draw a typical timber partition wall using timber frame. 6.13 Partition a given space in timber.		

	General Objective 7.0: Know the types, principles and rules governing stair construction and the method of constructing staircases in timber, steel and concrete.		
11	7.1 Define stair and stair case. 7.2 List the various types of staircases. 7.3 Define the terminologies used in staircase construction. 7.4 Draw the various types of staircases in plan, elevations and sections. 7.4 Derive risers, tread sizes, width of flight, width of mid-landing, etc, for the various types of staircases listed in 7.2 above. 7.6 Describe with the aid of sketches and according to building regulation requirements, the method of constructing various types of staircases in timber, steel and reinforced concrete.. 7.7 Construct timber and concrete stairs.	▪ Lecture, demonstration, supervision	▪ Teaching aids, timber, cement, aggregates.
	General Objective 8.0: Know the types of roofs ceiling structures and coverings.		
12 - 15	8.1 Explain with illustrations the methods of construction of various roof structures in timber, concrete ferrocement and steel and other materials. 8.2 State the properties and fixing details of various roof covering materials. 8.3 Explain with illustrations the drainage systems of various types of roofs. 8.4 Describe with drawing the water-proofing systems of the various types of roofs. 8.5 Enumerate the various types of ceilings. 8.6 State the functions of these types of ceilings. 8.7 Explain the methods of constructing these various ceilings.	▪ Lecture	▪ Teaching aids

Competency: The student shall have in-depth knowledge concrete and timber for building construction.
Assessment Coursework 20%; Course test 20%; Practical 20% Examination 40%.
References: 1. D.w. Watson "Building Construction" McMillan, 1987.
2. D.E. Warland "Construction Presses and Materials" Hodder and Stroughton London, 1979.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Civil Engineering Construction II	**Course Code: CEC 110**	**Contact Hours: 2 – 0 – 2**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the use of scaffolding.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Explain the principles of scaffolding. 1.2 State the use of scaffolding in walls, roof and suspended floor construction. 1.3 Explain the procedure for providing scaffolding for the various building types.	▪ Lecture	▪ Teaching tools.
2	**General Objective 2.0: Know the various types of fenestrations in buildings.**		
	2.1 Explain the functional requirements of openings in buildings. 2.2 Explain the treatment of doors, windows and other openings in buildings. 2.3 Explain the use of lintel and arch infenestrations. 2.4 List the various types of doors. 2.5 List the main principles to be observed in the construction of doors and framing of joiners work in general.	▪ Lecture with sketches and drawings of supervise.	▪ Teachers tools, door and window frames
3	2.6 Draw schedules of doors, windows and other openings in buildings. 2.7 Describe with the aid of sketches the methods of constructing the different types of framed and flush doors. 2.8 Describe the different types of door linings. 2.9 Explain the difference between a door frame and a door lining. 2.10 Describe the methods of fixing door frame and linings to openings. 2.11 List the various types of metal doors and the common materials used in their construction. 2.12 Describe with the aid of sketch a flush and a panel metal door. 2.13 Define the term iron-mongery.	- do -	- do -
4	2.14 List the method by which windows are classified. 2.15 Describe with sketches the method of constructing the various types of windows. 2.16 Illustrate the various components of doors and windows. 2.17 Fix doors and windows in a building.	- do -	- do -

	General Objective 3.0: Know the different types of finishes for floors, walls and ceilings.		
5	3.1 State the functions of finishes on floors, walls and ceilings. 3.2 Illustrate the different types of floor finishes in relation to their functions, e.g. terrazzo, grano p.v.e. etc. in terms of internal and external functions. 3.3 Illustrate the different types of wall finishes in relation to their functions in terms of internal and external functions.	▪ Lecture, supervise	▪ Teaching tools, paint, brushes, tiles, scaffold.
6	3.4 Illustrate the different types of ceiling finishes in relation to their functions in terms of internal and external functions. 3.5 Explain the use of various types of paints for different surfaces in relation to their finishes. 3.6 Paint given wall and ceiling surfaces. 3.7 Lay tiles on given floor area.	- do -	- do -
	General Objective 4.0: Understand the needs for external works around the buildings.		
7	4.1 Explain the essence of having external works around a building, drawing, grass, landscaping. 4.2 State the functions of external works in build in works. 4.3 Explain the functions of fencing and hedges in building.	▪ Lecture, supervise	▪ Drawings, drawing instruments.
8	4.4 State the conditions for providing roads, pathways, and parking lots to buildings. 4.5 State the functions of sewage plants, e.g. septic tank, soakaway pits, manholes, inspection, chambers, sewers.	- do -	- do -
9	4.6 Explain with illustration how sewage plants in 4.5 above are constructed. 4.7 State the underlying principles in planning a good drainage system. 4.8 Apply the principles of landscaping to a given site layout inculcating all items of external works.	- do -	- do -
	General Objective 5.0: Understand the general administration of building construction works.		
10	5.1 Explain the responsibilities of the various parties involved in the building industry: Client, Architect, Quantity Surveyor, engineers etc. 5.2 Define contract, different types of contracts and explain the procedures involved in signing and completion of contracts. 5.3 Describe the different types of tendering procedure.	▪ Lecture, provide example from a contract	▪ Teaching tools.
11	5.4 Outline the methods of site layout and organisation - precontract planning services on site, safety and security.	- do -	- do -

	5.5 Prepare one in your area of operation.		
	General Objective 6.0: Understand various requirements as regards fire precautions and regulation as applied to building.		
12	6.1 Describe means of escape and route.	▪ Lecture, supervise	▪ Teaching tools, burglar proofing materials.
13	6.2 List fire precautions in building. 6.3 Define fire resistance materials in building. 6.4 Describe various burglarproofing materials in buildings.	- do -	- do -
14	6.5 Fix burglarproofing materials. 6.6 Safety on construction sites.	- do -	- do -

Competency: The student shall have a comprehensive knowledge of installation techniques for scaffolds, finishes, glazing and other building components as well as administration and safety.

Assessment: Coursework 20%; Course test 20%; Practical 20%; Examination 40%.

References:
1. Harris and McCaffer, "Modern Construction Management" Blackwell Science, 1995.
2. D.E. Warland, "Construction Processes and Materials", Hodder and Stroughton, London, 1979.
3. J.R. Lewis, "Land for the Construction Industry", McMillan, 1976.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Civil Engineering Construction III	**Course Code: CEC 213**	**Contact Hours: 2 – 0 – 2**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the various processes and sequence of Highway Construction.**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 Explain the importance of Engineering Surveying in route location of Highways. 1.2 Illustrate how alignments, R.O.W, Profile levelling and cross sections are carried out. 1.3 Explain how bush claring, felling of trees, removal of storms are carried out. 1.4 Explain spoil and hauling of materials.	▪ Lecture	▪ Teaching Tools,
2	1.5 State the processes for the blasting of rocks. 1.6 Explain how setting out is done in intervals and mark out position for culverts and bridges, mention procedures for setting out targets and curves. 1.7 Explain the procedure for carrying out earthworks such as cutting and filling, subgrade. Emphasise the need for proper compaction in lifts of 150mm, Discuss current specifications, DOT etc. Explain the choice of borrow pits, their uses and control. 1.8 Mention various side drains and their relevance when used. 1.9 Explain thickness requirement, for sub-base, their compaction and relevant in-situ tests. Explain the need for camber, super elevetion, cross falls.	- do -	- do -
3	1.10 Mention the need for soil stabilization as a means of improving pavement material. Mention stone base (macadam) as alternative base material. 1.11 Explain priming as requirement for Tactcoat, the use of MCO or MCI. Also the use of sand for curing.	- do -	- do -
4	1.12 Mention the materials used for surface dressing and surface treatment such as cut-back bitumen, 80/100, Emulsion and stone chippings. Mention the need for more than one course for new roads i.e wearing course and surface course. 1.13 Explain the need for Asphaltic Concrete for high wheel loads. Mention components of Asphaltic Concrete such as penetration between 50-70, fine aggregates and crushed aggregates, including fillers, cement, dust. Mention use of Marshall stability for Asphaltic concrete. Differentiate between binder course and surface course. 1.14 Mention the use of concrete in Rgid Pavements. Explain the need for	- do -	- do -

	suitable joints in concrete pavements. 1.15 Mention the use of culverts (pipes and boxes) as drainage systems for small streams. Mention the use of drifts as a means of low-level crossing as alternative to cheap culverts. Differentiate between culvert and bridge.		
	General Objective 2.0: Know the various construction equipment required for Highway Construction.		
5	2.1 List the relevant equipment used in Highway Construction and mention what they are used for such: a. Ripper - for uprooting b. Bulldozers - for clearing c. Power saws - tree cutting/falling d. Motor graders - levelling and cutting of side ditches, spreading andCambering. e. Rollers - for compaction	▪ Lecture, show video filing of construction equipment and construction activity.	▪ Teaching tools, video, TV, Tape.
6	f. Payloaders - for loading trucks g. Trucks - for haulage h. Scrapers - for haulage earth, work, excavation. i. Water tankers - watering j. Crushing plant - production of aggregates. k. Stone - base mixing l. Plant - for production of stone base materials.	- do -	- do -
7	m. Bitumen sprayer - spraying hot bitumen or road surface. n. Asphalt mixing plant - for production of Asphalt. o. Asphalt paver - laying of Asphalt .	- do -	- do -
8	p. Construction site with reinforced concrete practice. q. Pavers - for spreading, compacting and finishing concrete pavement.	- do -	- do -
	General Objective 3.0: Know the safety devises required to be put in place during Highway construction.		
9	3.1 Explain the use of diversions in highway construction works. Mention the mandatory requirements for provision of diversion signs, information signs. Mention the use of flash lights, beacons, cones at dangerous locations. 3.2 Explain the need for safety provision after the highway construction. 3.3 Explain the need for foot bridges for pedestrians. Also the need for pedestrian walkways.	▪ Lectures	▪ Teaching tools
10	3.4 Mention the use of crash barriers for guiding vehicles in difficult terrain. 3.5 Explain the need for proper information on detours.	- do -	- do -

11	**General Objective: 4.0 Know the furniture required to be put in place on the completed highway.**		
	4.1 Explain the need for provision of road furniture such as road signs, sign posts, kilometer posts. Traffic lights etc. 4.2 Mention the need for the provision of utility ducts during highway construction e.g for water, Electricity and Telephone.	- do -	▪ Teaching tools ▪ Student bus, fuel.
12 – 14	4.3 Organise visit to three different sites.	- do -	- do -

Competency: Student shall be fully conversant with field processes, equipment, plants, safety and furniture for major Civil Engineering Construction.
Assessment: Coursework 20%; Course test 20%; Practical 20%; Examination 40%.
References: 1. Gichega, E.J. "Essential of Highway Engineering" McMillan Press, 1988.
2. A. Wignall & P.S. Kendrick "Roadwork – Theory and Practice", William Heinemann Ltd, London 1982.

MANAGEMENT

PROGRAMMES: CIVIL ENGINEERING			
Course: Entrepreneurship Development I		**Course Code: SDV 210**	**Contact Hours: 2 – 0 – 0**
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the basic concept of entrepreneurship		
	Specific Learning Outcome	**Teachers activities**	**Resources**
1	1.1 Define entrepreneurship, entrepreneur, small business and self-employment. 1.2 State the entrepreneurship philosophy identify entrepreneurial characteristics. 1.3 Identify entrepreneurial characteristics. 1.4 Define development enterprise.	▪ Lecture and site examples of each.	▪ Chalkboard
	General Objective 2.0: Understand the historical perspective of entrepreneurship development		
2	2.1 Historical perspective. 2.2 Trace the origin of entrepreneurship. 2.3 Explain organizational structure. 2.4 Explain the role of an entrepreneur. 2.5 Explain the reasons for business failure.	▪ Trace the historical evolution of business enterprise citing example Highlight the reasons for their failure/success.	▪ Chalkboard
	General Objective 3.0: Know how to plan a business enterprise/project.		
	3.1 Define the concepts: planning, business enterprise and project. 3.2 Explain the importance of planning to a business enterprise. 3.3 Analyse the skills and Techniques of starting and managing small business successfully.	▪ Lecture and illustrate with examples. ▪ Highlight to the students the initial problems likely to be faced. ▪ Invite a successful entrepreneur to deliver lecture to the students.	▪ Chalkboard
4 - 5	3.4 Prepare and present project proposal. 3.5 Manage a small business profitably.	▪ Lecture and introduce the students to the formats of various project proposal.	▪ Chalkboard
	General Objective 4.0: Know how to operate simple stock keeping records		
6	4.1 Ordering spare parts/materials 4.2 Receipt of parts/materials 4.3 Storage of parts/materials 4.4 Issue of parts/materials	▪ Lecture and demonstrate to students how to write recept and keep records of ordering, storage and issue materials.	▪ Store or any storage facility Record note-bookls.
	General Objective 5.0: Know how to prepare and operate cash flow on spreadsheets		
7	5.1 Need for different records (capital, revenue, credit transaction, tax)	▪ Lecture and demonstrate for	▪ Chalkboard and Computer

8	5.2 Formatting spreadsheet 5.3 Operating spreadsheet	the students to appreciate ▪ Give practical exercise to students.	
	General Objective 6.0: Understand employment issues		
9	6.1 Define the terms: education, training and development. 6.2 Retate education, training and development to employment. 6.3 Distinguish between skills and employment. 6.4 Explain the role of the private sector in employment generation.	▪ Lecture and cite examples.	▪ Chalkboard.
	6.5 Identify the forms and informal sectors. 6.6 Explain the issues of: (i) Rural youth and employment (ii) Urgan youth and employment.		
	General Objective 7.0: Understand the Nigerian Legal System		
10	7.1 Explain the nature of law. 7.2 Analyse the sources of Nigerian laws. 7.3 Evaluate the characteristics of Nigerian Legal System.	▪ Lecture	▪ Chalkboard
	General Objective 8.0: Comprehend the nature of contract and tort		
11	8.1 Define contract. 8.2 Explain types of contracts 8.3 State the basic requirements for a valid contract. 8.4 Analyse contractual terms.	▪ Lecture	▪ Chalkboard
12	8.5 Examine vitiating terms. 8.6 Explain breach of contract and remedies. 8.7 Define Tort. 8.8 Explain types of Tort. 8.9 Discuss tortuous liabilities and remedies.	▪ Lecture	▪ Chalkboard
	General Objective 9.0: Understand Agency and Partnership		
13	9.1 Define agency 9.2 Explain creation of Agency 9.3 Explain authority of the agent. 9.4 Analyse the rights and duties of principal agent and third parties. 9.5 Explain termination of agency and remedies.	▪ Lecture	▪ Chalkboard
	9.6 Define partnership. 9.7 Examine creation of partnership. 9.8 Explain relations of partners to one another and to persons dealing with them. 9.9 Analyse dissolution of partnership and remedies.l	▪ Lecture and cite examples	▪ Chalkboard

Competency: The student will understand and have sufficient knowledge to plan the establishment of a small business and realize the pitfalls involved.

Assessment: Coursework 20% Course tests 20% Practical 0% Examination 60%.

References:

1. Wole Adewumi, "Business Management An Introduction", McMillan Nig. Ltd. Lagos. 1988.
2. Soji Olokoyo, "Small Business Management Guide Entrepreneurs", Ola Jamon Printers and Publishers, Kaduna.

PROGRAMMES: CIVIL ENGINEERING			
Course: Entrepreneurship Development II	**Course Code: SDV 211**	**Contact Hours: 1-0-1**	
Course Specification **Theoretical Content**			
	General Objective 1.0: Understand Financial Management		
	Specific Learning Outcome	**Teacher Activities**	**Resources**
1 2	1.1 Define financial management 1.2 Explain sources and types of finding 1.3 Define the concepts of cost, price, revenue, profit and break-even point. 1.4 Explain financial statements e.g budgeting, balance sheet, profit and loss accounts, and cash flow budget. 1.5 Apply financial statements in business management.	▪ Lecture	▪ Chalkboard
	General Objective 2.0: Know how to prepare simple accounts.		
3 4	2.1 Dealing with assets 2.2 Preparing profit and loss statement. 2.3 Preparing balance sheet.	▪ Lecture and demonstrate with examples	▪ Chalkboard Examples of a balance sheet.
	General Objective 3.0: Know simple cost preparation		
5 6	3.1 Determining labour costs. 3.2 Determining direct machine cost. 3.3 Determine Overheads: labour, machine, and general	▪ Lecture. ▪ Give students examples in each area. ▪	- Ditto -
	General Objective 4.0: Know product and job costing		
7	4.1 product costing 4.2 Job costing 4.3 Project costing	▪ Lecture ▪ Give student a are history of study.	- Ditto – ▪ Case study data.
	General Objective 5.0: Understand the Laws relating to formation of Companies of Companies		
8 - 10	5.1 Identify the fundamental concepts in company law. 5.2 Explain memorandum and Articles of Association. 5.3 Explain promoters, promotion and the prospectus. 5.4 Distinguish between shares and debentures. 5.5 Analyse the functions and powers of Directors, Secretaries and Auditors. 5.6 Explain liquidation of companies.	▪ Lecture and give the students problems	▪ Chalkboard

	General Objective 6.0: Comprehend Labour and Industrial Law		
11	6.1 Analyse the laws relating to employer – employee relationship 6.2 Explain industrial safety laws. 6.3 Examine water and public health laws. 6.4 Evaluate land acquisition.	▪ Lecture	▪ Chalkboard
	General Objective 7.0: Understand Copyright and patent laws		
12 - 13	7.1 Explain copyrights 7.2 Explain patent. 7.3 Explain rights and liabilities under the copyrights and patient laws. 7.4 Evaluate beach and remedies	▪ Lecture	
	General Objective 8.0: Comprehend the nature of sale of goods		
14 - 15	8.1 Define contract of sale of goods 8.2 Distinguish sale of goods from other contracts e.g bastar, hire purchase and works and materials. 8.3 Explain duties of the parties. 8.4 Explain passing of properties and titles. 8.5 Examine breach and remedies.	▪ Lecture	

Competency: The students should be able to read and understand accounts and balance sheets, they should also have a knowledge of Nigerian Law as applied to business routine. A sound knowledge of financial control of a small business should be acquired.

Assessment: Coursework 20% Course tests 20% Practical 0% Examination 60%.

References:
1. Wole Adewumi, "Business Management An Introduction", McMillan Nig. Ltd. Lagos. 1988.
2. Soji Olokoyo, "small Business Management Guide Entrepreneurs", Ola Jamon Printers and Publishers, Kaduna.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Construction Management	**Course Code: CEC 242**	**Contact Hours: 2 - 0 - 2**	
Course Specification :Theoretical Content			
WEEK	**General Objective 1.0: Know the historical development in management.**		
	Specific Learning Outcomes	**Teachers Activities**	**Resources**
1	1.1 Describe the processes of industrial development and revolution. 1.2 Explain the evolution of Management 1.3 Explain the development of the scientific aspects of management. 1.4 State the achievements of the early pioneers in the field of management (Fayol, Taylor).	▪ Use question and answer techniques ▪ Give assignments	▪ Chalkboard ▪ Video ▪ OHP
2	**General Objective 2.0: Know the processes involved in the field of management.**		
	2.1 Explain the processes as regards forecasting, prediction planning, organising, preparing, motivating, commanding, controlling, coordinating and communicating.	▪ Lecture	- do -
3	**General Objective 3.0: Know the structure of a coordinated system of authority.**		
	3.1 Explain the organization charts and span of control. 3.2 Explain the structure and the parts of a division of an undertaking.	- do -	- do -
4	**General Objective 4.0: Know the relationship between authority responsibility and accountability.**		
	4.1 Explain the relationship between authority, responsibility and accountability.		
5	**General Objective 5.0: Know the different parties to a contract, forms of contract and contract procedures.**		
	5.1 Name the parties to a contract: Client, Architect, Engineer, Quantity Surveyor and Contractor (Prime). 5.2 Name the types of contract agreements, lump-sum, unit price, cost plus fee etc. 5.3 Explain the uses of contract documents	- do -	- do -
6	**General Objective 6.0: Know the concept of sub-contracting and the role of sub-contractors.**		
	6.1 Explain the processes involved in sub-contracting. 6.2 Explain the processes involved in selecting sub-contractors 6.3 Explain the works that can be subcontracted and the duties of a sub-contractor. 6.4 Explain the relationship between the prime and the duties of a sub-contractor.	- do -	- do -
7	**General Objective 7.0: Know the techniques of contract planning.**		
	7.1 Explain the principles of contract planning. 7.2 Explain the methods of programming work by using charts (programme and progress). 7.3 Explain the use of site meetings.	- do -	- do -

8	**General Objective 8.0: Know the importance of site layout.**		
	8.1 Draw a site layout plan. 8.2 Explain how the various accesses are suitable for the movement of men and materials on the site.	- do -	- do -
9	**General Objective 9.0: Know the need for quality control on site.**		
	9.1 Explain how quality control is applied to concrete, timber, reinforcement, erection and setting out during construction.	- do -	- do -
10	**General Objective 10.0: Know how resources for a project are obtained and allocated.**		
	10.1 Explain how skilled workers are recruited. 10.2 Describe how material (equipment and consumables) are procured. 10.3 Explain the need for a balanced crew (of skilled workmen) for a work element (e.g concreting). 10.4 Explain the factors to be considered in drawing up a list of equipment to be ordered for the works. 10.5 Explain the need for proper equipment handling and maintenance.	- do -	▪ Video, TV, Tapes.
11	**General Objective 11.0: Know how resources are used for production.**		
	11.1 Explain different kinds of production. Job production, Batch production and mass production. 11.2 Explain the need for proper storage of materials on site.	- do -	- do -
12	**General Objective 12.0: Know the need for safety on construction site.**		
	12.1 Explain the concept of safety on a construction site. 12.2 Explain how safety will reduce costs of construction. 12.3 Explain the need of keeping accident records on construction. 12.4 Explain the need for a safety programme on construction site. 12.5 State the role of management in a safety programme.	- do -	- do -
13	**General Objective: 13.0 Know the duties of a supervisor**		
	13.1 Explain the general duties of a supervisor. a. Towards junior worker, Towards employer, Towards visiting consultants. 13.2 Explain the advantages of a good supervisor. 13.3 Explain the disadvantages of a poor supervisor	- do -	- do -

14 – 15	**General Objective: 14.0 Know the elementary principles of accounting.**		
	14.1 Name the methods of transaction, debts, credit, double entry. 14.2 Explain the ledger, chart of accounts, trial balance and journal. 14.3 Explain financial statement and balance sheet. 14.4 Explain methods of calculating depreciation of equipment and other assets. 14.5 Draw up a ledger and prepare a balance sheet from given data.	- do -	Financial data.

Revision: 2 weeks

Competency: This course is design to acquaint the students to basic knowledge of construction management from planning to human relations, work ethics, quality control, safety and the supervisory role of the engineer on the field.

Assessment: Coursework 20%; Course test 20%; Practical 20%; Examination 60%.

Reference:
1. Harris and McCaffer, "Modern Construction Management" Blackwell Science, 1995.
2. Ivor H. Seelay, "Civil Engineering Contract Administration and Control", McMillan Education Ltd. London.

WORKSHOP PRACTICE

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Workshop Technology I		**Course Code: CEC 103**	**Contact Hours: 0 – 0 – 4**
Course Specification: Practical Content			
WEEK	**General Objective: To introduce the students to setting out, brickwork/brickwork, Carpentry and Woodwork.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1-3	Sketch a site layout to know how to set out a simple residential building foundation and super structure. Execute foundation trench and cast concrete.	▪ Guide students to prepare site plan ▪ Provide materials and supervise the execution in groups.	▪ Magnetic board ▪ Pegs, nails, line, angles, tapes, wooden rails, optical square, compass and other survey equipment
4	Set out a simple residential building blockwall super structure	▪ Demonstrate execution procedure and blinding. ▪ Supervise foundation construction. ▪ Demonstrate laying and bound for 9 inches hollow blocks filled with plain concrete	▪ ▪ Spades, diggers, Shovels, Wheelbarrows, Plumbs level, dumplevel, staff, rods, measuring tapes, concrete mixer, batching boxes. ▪ Sandcrete blocks, Cement, sand, crush aggregates, water, trowel, float, square, spirit level.
5	Provide separate pipes for waste water as drainage	▪ Demonstrate the plumbing for waste water.	▪ Pipes, blocks, yarning, Pipe range, threading , Machine, gums,
6	Laying of blocks/brick in different bonds	▪ Demonstrate the four bonds e.g English, Stretcher, Flemish, Cross etc.	▪ Blocks mortar, bricks, trwels, float.
7	Identify constraction wood types, sizes and nails (sizes), Screws.	▪ Make the students to identify available sizes in the market.	▪ Provide various sizes.
8	Prepare a piece of wood by hand and machine	▪ Demonstrate cutting, Planning, Chiseling.	▪ Workbench, Saw, Plane, Chisel, level, Tri-square with spirit level.

9	Prepare the layout of a standard Carpentry and joinery workshop.	▪ Guide students to prepare workshop layout.	▪ Cardboard, Drawing Sheets Drawing Materials
10	Prepare joints such as halving, Mortise, Tenor, Widening, Lapped, Fished and Car-Case Joints	▪ Show already prepared samples of various joints. Artisan to demonstrate and guide standards in production under Teachers' supervision.	▪ Wood, Vice, Work bench, Mallet, Chisels, Tool box, Saw, Gauge, Screw Gauge, Markers, Pencils, Chalk, Steel/Wooden nail.
11	Make use of metal dogs/fastening and gusset plates	▪ Show student the metal gogs, fastenings and gusset plates.	▪ Motel gogs, fastening and gusset plates.
12 - 13	Construct a. a single wooden floor b. a double wooden floor c. floor board joints d. wooden sills	▪ 1 m^2 single wooden floor, double wooden floor, Floor board joints and wooden sills prepare wooden tiles stripes and secure with adhesive including design joints, Lay wooden sills.	▪ Wood, adhesives.
14 - 15	Construct (a) centre for arches (b) timber shores (c) paneled doors, window/door fames (d) simple and belt-up roots (e) straight flight of stairs (f) door casing.	▪ Specify parabola, Semi circle and guide the construction	▪ Templates, Plywood. ▪ Reinforcement steel as necessary

Revision: 2 weeks
Competency: This course is intended to train the students in the skills of using tools and equipment in the carpentry and joinery workshop.
Assessment: Coursework 0%; Course test 20%; Practical 40%; Examination 40%.
References:
1. Bull, J.W. "The practical design of structural Elements in Timber", Gower Press, 1989.
2. Baird, J.A. and Ozelton, E.C, "Timber Designs Manual", Granada, 1984.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Workshop Technology II	**Course Code: CEC 203**	**Contact Hours: 0 – 0 – 4**	
Course Specification: Practical Content			
WEEK	**General Objective: PLUMBING, SEWAGE, WELDING AND ELECTRICAL INSTALLATION**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 - 2	Carry out the installation of a typical plumbing assignment including pipe runs for both cold and hot water services with jointing and threading out of pipes by various methods.	▪ Demonstrate practically a simple but typical plumbing installation. ▪ Guide and supervise installation including identifying the various materials and tools.	▪ Plastic copper and GI pipes including their elbows, beads, joints and valves yarn and pulty, pipe wreatch, pipe standing mobile vice mounted on a tripod, measuring tape and adhesives.
3 - 4	Bend different types of pipes (galvanised, steel, copper, etc) by various methods and perform various welding operations.	▪ Guide and supervise the students on all the activities of bending and welding of different pipes.	▪ Short length of pipes and various joints electrodes electric welding machine, gas welding machine, electricity, steel-rule, hack saw, pipe wrench, metal file, yarn putting and standing vice.
5	Carry out a survey on the sources of water supply and set out drain runs for surface water and sewage disposal.	▪ Supervise the operations	▪ Topographical maps of an area pegs, nails, hammer, cord line, measuring type, digger.
6	Carry out the installation of sanitary appliances	▪ Supervise the operation	▪ WC. WHB, Bath, putting, pipes, valves, pipe wrench, pipe wrench, hack saw and standing vice.
7	Use the principles of sewage disposal to propose a simple sewage treatment for your institution.	▪ Supervise the students	▪ Marlear board, Drawing materials
8	Perform cutting and filling operation's on steel, aluminium, tin, etc and also perform riveting activities.	▪ Supervise the students	▪ Steel, aluminium, tie steels and pipe, hack saw drilling and riveting machines
9 - 10	Carry out cable jointing, circuit exercise using various systems and simple installation including the installation of plugs, sockets, fuses,	▪ Supervise the students.	▪ Model building, simple electrical drawing, gas

	switches, function boxes, distribution boards, and circuit breakers.		welding/blow lamp, cables, plugs, sockets, fuses, switches, function boxes, distribution boards and circuit breakers.
12	Carry out maintenance of generating plants.	▪ Artisan mechanic and electrician to illustrate or demonstrate under the supervision the supervision of the teacher.	▪ Generating plant, engine oil, filters, tools, fan belts and other parts needed for maintenance.

Revision: 3 weeks
Competency: This course is designed to train students in the use of tools and equipment for Electrical, Mechanical and Plumbing works as it affect Civil Engineering works.
Assessment: Coursework 0%; Course test 20%; Practical 40%; Examination 40%.
Reference: 1. Marrice Lewis, "Electrical Installation Technology 3: Advanced Work", 2nd Ed. Stanley Thomas Ltd. London.
2. E. Keith Blan Kenbaker, "Modern Plumbing"

ENGINEERING MEASUREMENT AND SPECIFICATION

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Engineering Measurements and Evaluation		**Course Code: CEC 214**	**Contact Hours: 2 – 0 – 0**
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the duties and relation of professional in connection with Civil Engineering Contracts**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 List the functions of all professionals in a building industry. 1.2 State the relationship between the quantity surveyor architect and civil engineer etc in the building industry 1.3 List the functions of all professionals in the civil engineering works. 1.4 State the relationship between the professionals in civil engineering works.	▪ Use questions and techniques ▪ Give assignments	▪ Chalkboard ▪ Charts and audio visual aid video.
	General Objective 2.0: Know the main purposes of Civil Engineering Measurement And Evaluation.		
2 - 3	2.1 Explain the meaning of Bill Engineering Measurement and Evaluation (BEME) 2.2 Distinguish between BOQ and BEME. 2.3 Discuss the various uses of BEME in executing engineering contracts. 2.4 Use bill of engineering measurement and Evaluation (BEME) as a basis for tendering. 2.5 Use the BEME as an itemized list of components of civil engineering works. 2.6 Use BEME as a basis for the valuation of work for interim certificate and variations. 2.7 Use BEME as a basis for cost analysis and planning.	Use question and answer Use examples Give assignments	Examples/specimen
	General Objective 3.0: Understand choice of the methods of preparing Civil Engineering Measurements and Evaluation		
4	3.1 Explain the traditional methods of preparing quantities. 3.2 Describe the cut and shuffle method of preparing quantities. 3.3 Distinguish between the traditional, cut and shuffle methods. 3.4 Give the advantages and disadvantages of both methods.	▪ Use question and answer	- do -

	General Objective 4.0: Understand the general principles and rules to be followed in taking- off of Engineering Measurements and Evaluations.		
5 – 6	4.1 State the objectives and use of Civil Engineering standard method of measurement (CE SMM). 4.2 State the objectives and use of code for the measurement of Civil Engineering. Works. 4.3 Explain the general rules to sections of the SMM of Building Works and Civil Engineering Methods of Measurements. 4.4 List the units of measurement. 4.5 Explain with example what is meant by Timing. 4.6 Explain dotting on. 4.7 Describe waste calculation. 4.8 Use ampersand in taking-off. 4.9 Use NIL in altering dimensions. 4.10Determine the need for adjustment of openings and voids.	▪ Use question and answer ▪ Discuss 5mm for Building works and CE 8mm. ▪ Give assignment.	▪ CE 5mm ▪ 5mm for Building works.
	General Objective 5.0: Know the methods of measuring quantities for sub-structure from drawings of a small dwelling and Civil Engineering structure using standard methods of measurements.		
7 - 8	5.1 Measure quantities for excavation and earth work in sub-structure of Civil Engineering works including building. 5.2 Measure quantities for all concrete work in sub-structure of Civil Engineering works including building. 5.3 Measure quantities for all block work in substructure of Civil Engineering works including building.	▪ Make student carry out site measurements ▪ Use question and answer.	▪ Tapes, Linen ▪ Levels, chain drainings.
	General Objective 6.0: Analyse and build up unit prices and rate for civil engineering works including pricing of preliminary items.		
9-10	6.1 Build up unit prices and analyse rates for all materials required for Civil Engineering works. 6.2 Price preliminary items for Civil Engineering works. 6.3 Price temporary works and services for Civil Engineering works. 6.4 Explain break-even analysis. 6.5 Prepare schedule of materials. 6.6 Calculate pro-rata rates. 6.7 Build up rates for: a. Roof work b. Finishes including Painting and Decoration c. Drainage and External Works 6.8 Build up unit rates for: a. surface excavation, trenches and isolated holes,earthwork	▪ Make student carry out site measurements ▪ Use question and answer.	▪ Tapes, Linen ▪ Levels, chain drainings.

	support to simple excavations, basement excavation, disposal of spoil hardcore. b. concrete to strip foundations, ground floor slab, including formwork and reinforcement. c. Walls in common and facing bricks and blockwork.		
11 – 13	**General Objective 7.0: Understand the principles of abstracting and billing.**		
	7.1 Abstract the squared dimensions from the taking-off sheets into an abstract sheet in recognized order. 7.2 Prepare bill of engineering measurement from a given abstract sheet in a recognized order	▪ Use question and answers. ▪ Give assignments.	- do -
14	**General Objective 8.0: Understand the principles of specification writing.**		
	8.1 Define specification. 8.2 Explain the different types of specifications. 8.3 State the importance of specification.	▪ Use question and answer. ▪ Give assignments to students	▪ Chalkboard ▪ Examples of specifications.

Revision: 3 weeks

Competency: This course is intended to acquint the student with the basic knowledge of preparing Bill of Engineering Measurement and Evaluation (BEME) for structural engineering work with an introduction to specifications writing.

Assessment: Coursework 20%; Course test 20%; Practical 10%; Examination 50%.

Reference:
1. Ivor H. Seelay, "Civil Engineering Quantities", McMillan Education Ltd. London 3rd Ed.
2. Ivor H. Seeley, "Civil Engineering Specification" 2nd Ed. McMillan Educ. Ltd. London.

HYDRAULICS AND HYDROLOGY

PROGRAMME: Civil Engineering Technology			
Course: Introductory Fluid Mechanics	**Course Code: CEC 107**	**Contact Hours: 1 – 0 - 2**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the general properties of fluids**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define fluids (gases and liquids). 1.2 Distinguish between solids and fluids 1.3 Explain the properties of liquids, and gases viz: density, specific gravity, specific volume pressure, viscosity, surface tension and capillary (with units and introduction of dimensions). 1.4 Explain diffusion of liquids and gases. 1.5 Determine above properties experimentally.	▪ Lecture and state relationship between the quantities.	▪ chalk and board
	General Objective 2.0: Know fluid static's and pressure effects on fluids.		
2.	2.1 Explain variation of pressure with depths. 2.2 Explain the uses of manometers and pressure gauges (barometers). 2.3 Differentiate between absolute and gauge pressures. 2.4 Discuss the application of pressure variation e.g. Hydraulic Jack etc.	▪ Lecture and illustrate with simple calculations.	▪ chalk and board
	General Objective 3.0: Understand buoyancy of floating bodies.		
3.	3.1 Define buoyancy 3.2 State the conditions of equilibrium of floating body 3.1 Define metacentric height. 3.2 Determine the metacentric height experimentally	▪ Lecture and illustrate each with relevant calculations.	▪ Chalk ▪ Setquare
	General Objective 4.0: Understand the basic principle of fluid motion.		
4	4.1 Explain types of flow (i.e. basic definition). 4.2 State continuity equation, momentum equation and Bernoulli's Theorem.	▪ Lecture, and illustrate with calculations.	- do -
5	4.3 Demonstrate 4.2 experimentally 4.4 Verify 4.2 experimentally. 4.5 Solve simple problems using 4.2 above.	- do -	- do -

	General Objective 5.0: Know about flow through office weirs etc.		
6	5.1 Explain the application of ventri-meter and pitot tube. 5.2 Explain flow through notches and weirs. 5.3 Identify the flow n small and large orifices 5.4 Establish relationship between flow rate and pressure difference. 5.5 Determine experimentally the relationship between head and sill of weirs and discharge rate.	▪ Lecture, demonstrate	▪ Different, chalk types of weirs, notches.
	General Objective 6.0: Understand the different types of flow in pipes		
8	6.1 Define types of flow in pipes. 6.2 Define laminar flow 6.3 Define turbulent flow. 6.4 Explain Reynolds number 6.5 State Darcy's formula 6.6 State Chezy's formula	▪ Lecture, and illustrate with worked examples	▪ Chalk
9	6.7 Explain head losses in pipe (i.e. roughness coefficients) 6.8 Explain local losses in pipes, i.e. sudden expansion and contraction, bends, valves, gates, etc. in shear flow situation.	- do -	- do -
10	6.9 Explain pressure and velocity ideal fluids and in shear flow situation. 6.10 Investigate experimentally the relationship between Darcy's Friction coefficient and Reynolds number for lamina, turbulent flows and flow in smooth pipes.	- do -	- do -
11	6.11 Distinguish between pumps and turbines. 6.12 Explain energy transformation by pumps turbines.	- do -	- do -
	General Objective 7.0: Understand the nature of uniform flow in open channel		
13	7.1 Explain open channel flow 7.2 Explain uniform flow in open channel	▪ Lecture and illustrate with calculation	▪ Chalk
14	7.3 Describe most economical sections. 7.4 Establish experimentally the uniform flow condition obtaining the values of rectangular channel and manning coefficient for a channel.	- do -	- do -

<table>
<tr><td colspan="4">PROGRAMME: ND1: Civil Engineering Technology</td></tr>
<tr><td colspan="2">Course: Introduction to Fluid Mechanics</td><td>Course Code: CEC 107</td><td>Contact Hours: 2 - 0 - 0</td></tr>
<tr><td colspan="4">Course Specification: Practical Content</td></tr>
<tr><td>WEEK</td><td colspan="3">General Objective: Carry out Various experiment to help the understanding of the Theoretical Content</td></tr>
<tr><td rowspan="11">3</td><td>Specific Learning Outcome:</td><td>Teachers Activities</td><td>Resources</td></tr>
<tr><td>Carryout experiment to
a) Measure densities of fluids</td><td rowspan="10">▪ In all these practical sessions, the technologist should prepare samples and equipment under the supervision of the lecturer.
▪ Technologist should assist students with methodology, monitor students during practical, grade the students work and submit grades to the lecturer.</td><td rowspan="10">▪ stability of floating bodies apparatus
▪ venturi meters, v-notch
▪ centre of pressure apparatus
▪ flow visualization equipment.
▪ Laminar and turbulent flow pipes.
▪ Current meters
▪ Equipment for properties of fluids
▪ Friction loss equipment
▪ Hydraulic beach
▪ Flow visualization equipment
▪ Pitot tube.</td></tr>
<tr><td>4</td><td>b) Measure specific gravities of fluids</td></tr>
<tr><td>5</td><td>c) Measure the intensity of liquid pressures.</td></tr>
<tr><td>6</td><td>d) Measure the viscosity of fluids</td></tr>
<tr><td>7</td><td>e) Measure surface tension and capillarity</td></tr>
<tr><td>8</td><td>f) Determine diffusion of fluids and gases</td></tr>
<tr><td>9</td><td>g) Determine partial pressure of gases and fluids</td></tr>
<tr><td>10</td><td>h) Determine metacentric height</td></tr>
<tr><td>11</td><td>i) Investigate the relationship between Dary’s friction and Reynold’s number for laminar, turbulent flows and flow through smooth pipes.</td></tr>
<tr><td>12 - 14</td><td>j) Establish uniform flow conditions in rectangular channels.</td></tr>
</table>

Competency: The student should be able to understand static and dynamics of fluid and be able to solve simple practical problems.

Assessment: Coursework 20%; Course test 20%, Practical 20%; Examination 40%.

Reference: Open Channel Hydraulics Van top Chow, Hydraulics in Engineering (1986) Chulwick A, Allan and Unwin.

PROGRAMME: Civil Engineering Technology			
Course: Introductory Hydrology	**Course Code: CEC 102**	**Contact Hours: 1 – 0 – 2**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the concept of Hydrologic Cycle**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define hydrology. 1.2 Explain the hydrologic cycle. 1.3 Outline the importance of the cycle in water resources development.	▪ Lecture and illustrate with shematic diagram of hydrologic cycle.	▪ Chalk and board.
	General Objective 2.0: Understand what make up the weather and climate of a place.		
2	1.12 Distinguish between weather and climate.	▪ Lecture and show the students the various instruments used in measuring weather conditions	▪ Chalk and board
3	2.2 State the effects of the following on weather and climate a. Latitude and longitude controls b. Earth rotation and revolution c. Amount of distribution and type of precipitation d. Temperature e. Wind-speed and direction f. Humidity g. air pressure h. sky condition (cloudy and clear)	Ditto	- do -
4	2.3 List the various apparatus for measuring weather conditions. 2.4 Explain the factors responsible for the climate of a place.	Ditto	- do -
	General Objective 3.0: Understand precipitation as an important component of the hydrological process.		
	3.1 Define precipitation 3.2 Describe the formation of precipitation. 3.3 Explain the types and mechanisms of formation of precipitation e.g. cyclonic, convective and orographic precipitation.	▪ Lecture and sketch the diagrams of the various rain gauges.	▪ Chalk, and board, rain gauges.
	3.4 Describe the mechanisms of formation of precipitation's stated above. 3.5 Distinguish between various forms of precipitation – drizzle, rain, glaze, sleet, show and hail. 3.6 Recognise the basic instruments for the measurement of		

	precipitation. 3.7 Outline the working and operation of rain gauges such as recording and non-recording gauge		
7	3.8 Outline the sources of errors in reading these instruments. 3.9 Explain the need to establish a network of gauge stations in an area. 3.10 Describe the factors to be considered in siting or locating gauges.	Ditto	Ditto
8	3.11 Carry out measurement of precipitation in your environment. 3.12 Describe rainfall intensity, frequency and duration, amount or depth of precipitation and area extent.	Ditto	Ditto
	General Objective 4.0: Understand the basic concept of evaporation and transpiration.		
9	4.1 Define evaporation and transpiration 4.2 Explain the factors affecting evaporation and transpiration.	▪ Lecture	▪ Chalk and board
10	4.3 State the significance of evaporation and transpiration in reservoir management.	Ditto	Ditto
11	4.4 Carryout measurement of evaporation and transpiration.	Ditto	Ditto
	General Objective 5.0: Know the basic concepts of run-off		
12	5.1 Define run-off 5.2 Outline the factors affecting run-off 5.3 Compute quantities of run-off from a given area by various methods.	▪ Lecture and illustrate by solving a calculation based problem	▪ Chalk and board
13	5.4 Relate quantity of run-off to water shed drainage 5.5 Use rain fall intensity – duration for computing run-off	Ditto	Ditto
	General Objective: 6.0 Understand the processes of infiltration and interception		
14	6.1 Define infiltration and interception. 6.2 Recognise the factors affecting infiltration and interception. 6.3 Outline the methods of measuring infiltration and interception	▪ Lecture and sketch the graph of infiltration rate against time.	▪ Chalk, board infiltrometer.
15	6.4 Describe the equipment of measuring infiltration.	▪ Lecture	Ditto

Competency The student is introduced to the subject of surface Hydrology with emphasis on the hydrological components.
Assessment Coursework 20%; Course test 20%; Practical 20%; Examination 40%.
Reference: Handbook for Hydrology and Water Resources Uustate S and Yussuf A.M.

PROGRAMME: ND1: Civil Engineering Technology		
Course: Introduction Hydrology	**Course Code: CEC 102**	**Contact Hours: 1 – 0 – 2**
Course Specification: Practical Content		

WEEK	General Objective:		
	Special Learning Objective:	**Teachers Activities**	**Resources**
2 – 14	1. Take meteorological records over a period of three months to determine a. The rate of evaporation b. Speed of wind c. Volume of rainfall d. Water infiltration and percolation e. Temperature differences over one year f. Humidity and heat generation in the town in which the institution is situated and comment on their application to Civil Engineering works and develop i. Intensity - duration curve ii. Depth - Area duration curve 2. Carry out experiments on the hydrology apparatus 3. Measure river flow using floating methods	▪ Obtain records from the schools meteorological station and direct the students on how the various parameters are obtained. ▪ visit hydrometerological stations nearby. ▪ Direct students on how the various curves are drawn. ▪ The hydrology apparatus ▪ Explain procedure and selection of straight section of stream.	▪ Calculators ▪ Graph papers ▪ Chalk board ▪ French curves ▪ Metre rules ▪ Meteorology station ▪ Hydrology (watershed) apparatus ▪ Floats ▪ Stop watch ▪ Measuring Tapes.

PROGRAMME: Civil Engineering Technology			
Course: Hydro-Geology	**Course Code: CEC 207**	**Contact Hours: 1 - 0 – 1**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the occurrences of ground water distribution and their uses.**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1 – 2	1.1 Name the occurrences of groundwater 1.2 Describe how groundwater resources can be used. 1.3 Describe how groundwater affects engineering construction.	▪ Lecture	▪ Chalk and board.
	General Objective 2.0: Understand factors that affect water movement in soils		
3 – 6	2.1 Name the factors that affect the movement of water in soils. 2.2 Define each of the factors in 2.1 above. 2.3 Define aquifers 2.4 Distinguish between different types of aquifers (aquiclude, aquitard, aquifuge) 2.5 Illustrate flow patterns in different types of aquifers.	▪ Lecture	▪ Chalk and board
	General Objective 3.0: Know the principles of groundwater investigation/exploration.		
7	3.3 Name the different types of groundwater investigation techniques	▪ Lecture and demonstrate the various methods.	▪ Chalk and board
8	3.4 Explain each of the types in 3.1 above, e.g, electrical and electromagnetic seism retraction etc.		
	General Objective 4.0: Understand the principles of Groundwater exploitation.		
9	4.1 Define water table 4.2 Explain the factors that affect aquifer yield.	▪ Lecture and solve calculation based problem to illustrate well, hydraulics.	▪ Chalk and board
10	4.3 Illustrate the various methods of ground water exploitation e.g. bore-hole, shallow wells, deep wells, open wells, infiltration galleries, artesian wells,.	- do -	- do -
11	4.4 Know various drilling equipment	- do -	- do -
12	4.5 Describe methods of artificial recharge.	- do -	- do -
	General Objective 5.0: Understand the chemical characteristics of groundwater.		
13	5.1 Name the sources of impurities in groundwater 5.2 Identify the causes of specific types of impurities. 5.3 Explain the possible methods of prevention groundwater pollution and contamination.	▪ Lecture ▪ To identify the ongoing drilling site and guide	▪ Chalk and board ▪ Vehicle to convey students to sites.

	5.4 Carryout practical exercises on each topic above. 5.5 Carryout an excursion visit to bore-hole drilling sites and be acquainted with drilling principles and operations such as the drilling rig and its components drilling chemicals, lithologic samples and their interpretation (bore-hole design).	students appropriately. Explain well-logging to students	

Competency: Students expected to have indepth knowledge of ground water location, movement, quality and harnessing Techniques.
Assessment Coursework 20%; Course test 20%; Practical 20%; Examination 40%.
Reference:
1. Hydrogeology (1959) Wister GO, John Wiley
2. Hydrrogeology (1966) Davis S.W. John Wiley

PROGRAMME: Civil Engineering Technology			
Course: Hydraulics and Hydrology	**Course Code: CEC 201**	**Contact Hours: 2 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the importance of uniform flow in open channel.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Explain mean flow velocity in uniform flow 1.2 Define shear. 1.3 Use Darcy-Weisbach's Equation	▪ Lecture and apply the two equations to solve uniform flow problems	▪ Chalkboard, Drawings, Charts ▪ Pictures ▪ OHP
2	1.4 Use Chezy's and Mannings Equations 1.5 Describe the factors affecting velocity distribution	- do -	- do -
	General Objective 2.0: Understand the importance of non-uniform flow in open channel		
3	2.1 Explain the application of energy and momentum principles. 2.2 Define specific energy	▪ Lecture	- do -
4	2.3 Explain equation for critical depth 2.4 Define hydraulic-jump. 2.5 Explain physical concept of hydraulic-jump and its location.	- do -	- do -
5	2.6 Define energy dissipation, weirs and venturimeters 2.7 Explain the concept of flow over spillways	- do -	- do -
	General Objective 3.0: Understand the importance of unsteady flow.		
6	3.1 Describe the application of unsteady flow equations in channels, rivers, backwater cones, and similitude.	- do -	- do -
7	3.2 Describe the application of dimensional analysis in solving basic hydraulic problems.	- do -	- do -
	General Objective 4.0: Know the different types of instruments for measuring precipitation		
8	4.1 Description the use of non-recording gauges 4.2 Describe the use of recording gauges. 4.3 State the advantages and disadvantages of these guages. 4.4 Use guages to measure precipitation.	- do -	- do -
	General Objective 5.0: Understand the method of determining average precipitation over an Area using precipitation data.		
9	5.1 Describe the following methods a. Arithmetic mean method. b. Thiessen method	- do -	- do -

	c. Isohyetal method		
10	5.2 Compute the average precipitation using the method in 5.1 above.	- do -	- do -
	General Objective 6.0: Understand rainfall analysis and their applications		
11	6.1 Describe the following: a. Intensity of precipitation b. Duration of precipitation c. Frequency of precipitation d. Area extent of precipitation	- do -	- do -
12	6.2 Explain the following curves: a. Intensity – Duration curve b. Intensity – Duration – Frequency curve c. Depth – Area – Duration curve 6.3 Use the method of estimating missing precipitation record.	- do -	Examples of Durations Curves.
	General Objective 7.0: Understand the concept of evaporation and the factors affecting it.		
13	7.1 Describe the process of Evaporation. 7.2 Describe how the following affect evaporation: a. Radiation b. Wind c. Temperature d. Humidity 7.3 Carryout an experiment of evaporation 7.4 Describe fully the effect of the nature of evaporating surface on evaporation.	- do -	- do -
	General Objective 8.0: Understand the nature of evaporating surfaces, and the different methods of measuring evaporation.		
14	8.1 Describe: (a) Water budget determination of reservoir evaporation: (b) Energy budget determination of reservoir evaporation; (c) Direct measurement of evaporation by pan.	- do -	- do -

Competency: Students are to acquire the basic principles of Hydraulics and surface Hydrology and carry out simple calculations.
Assessment: Course work 20%; Course test 20%; Practical 20%; Examination 40%.
Reference: 1. French, R.A.: Open Channel Hydraulics" Mcgrair till 1994
2. Raghuren, HM "Hydrology Principles, Analysis and Design, Wiley, New Delhy.

PROGRAMME: ND1: Civil Engineering Technology		
Course: Hydraulics and Hydrology	**Course Code: CEC 201**	**Contact Hours: 2 – 0 – 3**
Course Specification : Practical Content		

WEEK	**General Objective:**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 - 15	1. Carryout measurement of rainfall using rain gauges. 2. Determine infiltration capacities, Fc. 3. Determine permeability K of a soil specimen. 4. Carryout evaporation measurements. 5. Produce drawings or representations of interpretation graphs for precipitation 6. Investigate the validity of Bernoulli's equation as applied to flow of water. 7. Investigate Laminar and turbulent flow in a pipe with applications. 8. Study Head – discharge relationship for a. rectangular notch b. V-notch	▪ Technologist to be responsible for setting up, assisting students under the supervision of lecturers.	▪ Rain gages, Rain fall Hydrograms. ▪ Infiltrometer, evaporation pans, ▪ Thermometers. ▪ Anemometer, evaporation pans, ▪ Flow measuring apparatus, flow channels, Hydraulic bench, permeability tanks, Reynolds and transitional flow apparatus, surge and water Hammer apparatus, Drainage/ seepage tank.

Competency: Students are to acquire the basic principles of Hydraulics and surface Hydrology and carry out simple calculations.
Assessment: Course work 20%; Course test 20%; Practical 20%; Examination 40%.
Reference: 1. French, R.A.: Open Channel Hydraulics" Mcgrair till 1994
2. Raghunath, HM "Hydrology Principles, Analysis and Design, Wiley, New Delhy.

SOIL MECHANICS/GEOLOGY

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Science and Properties of Materials	**Course Code: CEC 104**	**Contact Hours: 2 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the internal structure of the atom.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define clearly the characteristics of electron, proton, and neutron. 1.2 Predict element positions in the periodic table. 1.3 Explain exceptions to rule of thumb. 1.4 Describe the duality concept clearly. 1.5 Describe clearly the Wave and Corpuscular models. 1.6 Explain De-Broglie's expressions. 1.7 Explain schrodinger's equation. 1.8 Derive Bohr's conc'usion. 1.9 Describe how Bohr's conclusion explains atomic equilibrum, excitation, ionization state. 1.10Illustrate ionic, co-vallent and metallic bonds.	▪ Define, Predict, ▪ Explain, Describe, ▪ Derive and Illustrate.	▪ O/H Projector, ▪ Chalk board, writing tools.
	General Objective 2.0: Understand the microstructure of solids.		
2	2.1 Describe clearly the crystalline structure of metals, ceramics, etc. 2.2 Describe clearly the crystalline nature of polymer fibres. 2.3 Describe separate phases, alloys filled materials and composite materials. 2.4 Describe, in detail, the various methods of studying microstructures. 2.5 Illustrate these with diagrams. 2.6 Describe the behaviour of charge carriers. 2.7 Differentiate between majority and minority charge carriers. 2.8 Define charge density and temperature. 2.9 Define mobility, diffusion and conductivity.	▪ Describe, ▪ Illustrate, Differentiate, ▪ Define.	▪ O/H Projector, ▪ Chalk board, writing tools.
	General Objective 3.0: Understand the macroscopic properties of materials.		
3	3.1 Explain the relationship between macroscopic properties and structural properties. 3.2 Distinguish between elastic and plastic deformation. 3.3 Define stress and strain . 3.4 State the relationship between stress and strain. 3.5 Define modulus of elasticity. 3.6 Determine 3.5 by experiment and from experimental data.	▪ Explain, distinguish, ▪ State, Define, ▪ Determine, Describe.	▪ O/H Projector, ▪ Chalk board, writing tools. ▪ Strength of Materials, Lab.

	3.7 Define yield, plastic flow, creep. 3.8 Define conductors and semiconductors. 3.9 Describe dielectric, piezeoelectric, and magnetic properties of solids.		
	General Objective 4.0: Know various types and properties of aggregates used in Civil Engineering		
4 5	4.1 State Civil Engineering aggregates. 4.2 Describe various common quarrying methods. 4.3 Explain the properties of aggregate e.g porosity, absorption, void ratio, etc. 4.4 Describe tests for cleanliness, silt test. 4.5 Describe methods of moisture content determination and uses. 4.6 Describe grading methods. 4.7 Perform grading test. 4.8 Describe crushing strength tests. 4.9 Perform the crushing strength tests.	State, Describe, Explain.	O/H Projector, Chalk board, writing tools, Plus Concrete Laboratory
	General Objective 5.0: Know types and properties of other materials used in Civil Engineering Construction.		
6-11	5.1 Describe the use and application of stones in construction works 5.2 Describe the use and application of earth, soil and laterite construction works. 5.3 Describe the production and usage of fired clay in construction works. 5.4 Describe the uses of binders in construction works 5.5 Describe use of plastics in construction works. 5.6 Describe types and properties of glass. 5.7 Describe use and application of tar, bitumen and ashphalt. 5.8 State types and properties of asbestos. 5.9 Define corrosion. State effects as well as prevention. Carryout the following tests on stabilized and non stabilized materials (field tests colour touch, luster, adhesion, washing, visual, water retention, dry strength, thread, ribbon, sedimentation, etc.) Laboratory tests (Linear shrinkage , wet sieving, siphoning, grain-size, atterberg limit, compaction, CBR etc).	▪ Describe, State.	▪ O/H Projector, ▪ Chalk board, writing tools, ▪ Plus Concrete Laboratory
	General Objective 6.0: Know the types and properties of cement.		
11	6.1 Distinguish between, the different types of cement. 6.2 Describe the methods of cement manufacture. 6.3 Describe the acceptability tests for cement, e.g fineness, setting	▪ Distinguish, Describe.	▪ O/H Projector, ▪ Chalk board, writing tools,

	time, soundness, etc. 6.4 Perform the acceptability tests for cement.		▪ Plus Concrete Laboratory
	General Objective 7.0: Understand the properties and uses of concrete.		
	7.1 Describe, with illustrations, proper and improper storage of materials. 7.2 Describe concrete batching, mixing and transporting methods. 7.3 Describe standard tests for concrete e.g slumps tests, compaction factor, compressive strength test (cube, cylinder). 7.4 Perform standard tests in 7.3 7.5 Describe types of concrete pumps, placers, vibrators, etc. 7.6 Describe proper protection and curing of concrete. 7.7 Describe, with illustration, the bending and fixing of reinforcement. 7.8 Illustrate, with sketches, different types of joints in concrete. 7.9 Define proper concrete finishes. 7.10 State the effect of corrosion on metals with regard to structural stability. 7.11 State the causes of and methods of preventing corrosion.	▪ Describe, Illustrate, Define, State.	▪ O/H Projector, ▪ Chalk board, writing tools, ▪ Plus Concrete Laboratory
	General Objective 8.0: Know Properties and Uses of Ferrocement		
	8.1 Explain the meaning of ferrocement. 8.2 Distinguish between sandcrete, reinforced concrete and ferrocement. 8.3 Enumerate the uses of ferrocement in: a. Building construction; b. Underground construction works; c. Airport facilities; d. Road works; e. Water projects and f. Agricultural facilities. 8.4 Describe the properties of ferrocement such as: (a) tensile (b) flexural strength (c) compressive strength (d) impact and fatigue strength (e) water (or liquod) retaining capacity. Etc.		
	8.5 Enumerate the guidelines for the use of ferrocement e.g (a) Materials (b) Testing (c) Design (d) Construction. 8.6 Discuss the criteria of choice of micro-reinforcement in concrete		

	composites. 8.7 Explain the use of ferrocement as a means of producing skinned elements in buildings e.g ribbed plates, floor slabs, walls, joints below floor slabs and walls etc.		
	8.8 Explain the properties of bamboo that make it useful in construction industry. 8.9 Describe the construction of the following with bamboo: a. split-bamboo piles (foundation) b. bamboo floor c. bamboo reinforced earth walls d. bamboo roofs structures e.g. i. barrel vault ii. small geodesic dome iii. grid shell on a square base iv. irregularly shaped grid shells v. bamboo trusses vi. bamboo shingles with splint or string fixing vii. bamboo shingles as Spanish tiles		

Competency: The course is designed to teach the students the Science and Properties of Construction materials.
Assessment: Coursework 10%; Course tests 10%; Practicals 20%, Examinations 60%.
References: 1. Neville, A.M. "Properties of concrete" Mcmillan 1994.
2. Talor, G.H. " Construction Materials". Longman 1991.

<table>
<tr><td colspan="4">PROGRAMME: ND CIVIL ENGINEERING TECHNOLOGY</td></tr>
<tr><td colspan="2">Course: Science and Properties of Materials</td><td>Course Code: CEC 104</td><td>Contact Hours: 2 – 0 - 3</td></tr>
<tr><td colspan="4">Course Specification: Practical Content</td></tr>
<tr><td rowspan="2">WEEK</td><td colspan="3">General Objective: Conduct Practicals to explain the theoretical Content</td></tr>
<tr><td>Specific Learning Outcome</td><td>Teachers Activities</td><td>Resources</td></tr>
<tr><td>2</td><td>Carry out the following tests on a given cement sample:
a. Consistency
b. Initial and final setting time
c. Soundness</td><td rowspan="2">▪ Technologist to prepare cement and concrete samples in the presence of the students and monitor students during the practical.
▪ He is to grade students reports and submit to lecturer.
▪ The course lecturer is to supervise the above activities and collate the results of the graded practical.</td><td rowspan="2">▪ Vicat apparatus Le Chatelier test apparatus,
▪ 150mm cube moulds,
▪ 150mm cylindrical ,
▪ Engine oil
▪ Curing tank fall of water.
▪ DEMIC gauge</td></tr>
<tr><td>3 – 5</td><td>Perform the following tests on samples of concrete.
a. Cast concrete cubes 12 in number and one cylindrical in shape.
b. Cure in water
c. Test 3 samples of cube after 7 days
d. Test 3 samples of cube after 14 days
e. Test 3 samples of cube after 28 days
Compare results obtained with those specified in BS 12. Text the cylindrical concrete after 28 days and obtain the modulus of elasticity of concrete.</td></tr>
<tr><td>6</td><td>Determine modulus of elasticity.</td><td></td><td></td></tr>
<tr><td>7</td><td>Perform grading tests and crushing strength tests on concrete.</td><td></td><td></td></tr>
<tr><td>8 – 9</td><td>Carry out field tests on soils and laterite.</td><td></td><td></td></tr>
<tr><td>10 – 11</td><td>Carry out laboratory tests on soil and laterite.</td><td></td><td></td></tr>
<tr><td>12</td><td>Carry out structural properties of ferrocement i.e tensile, cracking, in pact strength fatigue strength, compressive strength.</td><td></td><td></td></tr>
<tr><td>13 - 15</td><td>Design and construct a structure with either ferrocement or bamboo.</td><td></td><td></td></tr>
</table>

PROGRAMME: Civil Engineering Technology			
Course: Engineering Geology and Basic Soil Mechanics	**Course Code: CEC 108**	**Contact Hours: 2 – 0 - 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the nature and composition of the earth crust.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define geology. 1.2 Explain the geological formation etc the earth. 1.3 State the 3 different types of rocks. 1.4 Explain the formation of the 3 different types of rooks. 1.5 Explain the physical characteristics of minerals. 1.6 Describe the chemical composition of rocks. 1.7 Identify the petrological characteristics of igneous rocks 1.8 Explain the formation of sedimentary rocks. 1.9 Describe fully the different types of erosion 1.10 Describe all forms of soil deposit 1.11 Explain earthquakes, isostacy, ocean floor and continental drift, modern plate tectonics.	▪ Use question and answer techniques ▪ Lecture ▪ Give assignments	▪ Chalkboard/0-H projector, papers, soft point, Chalk, Biro, Pencil, eraser, transparencies
	General Objective 2.0: Know all aspects of structural geology		
2	2.1 Explain the different structural aspects of geology (strike, joints, cleavage, dip, fold, fault, land slides and thrust). 2.2 Describe the relationship between strata and outcrops. 2.3 Interpretation of geological maps. 2.4 Produce dips and strikes from geological maps.	- do -	▪ Chalkboard/0-H projector, papers, soft point, Chalk, Biro, Pencil, eraser, transparencies
	General Objective 3.0: Understand geological surface processes		
4	3.1 Describe the agents of denudation and other types of weathering 3.2 Describe product of denudation.	- do -	- do -
	General Objective 4.0: Understand principal geological factors affecting some engineering projects.		
5	4.1 Describe the geological factors affecting stability of slopes' cuttings and embankments. 4.2 Mention geological conditions affecting impounded surface water (reservoir and dam sites). 4.3 Describe geological consideration in tunneling drilling, and foundations.	▪ Describe and define fault, joint, slope softening, solifluction, micro – and micro geological features.	▪ Chalkboard/0-H projector, papers, soft point, Chalk, Biro, Pencil, eraser, transparencies

	General Objective 5.0: Know about soil mechanics, its applications ad classifications in Civil Engineering.		
6 – 8	5.1 Define soil mechanics. 5.2 Differentiate between engineering soil and other soil types. 5.3 Explain the role of soils in Civil Engineering. 5.4 Explain the different types of soil 5.5 Explain classification of soil. 5.6 Explain classification by Grain Size and M.I.T/ Consistency method. 5.7 Describe in detail the properties of soil aggregates (Void Ratio Porosity, Moisture, etc.). 5.8 Work test examples of above. 5.9 Perform soil classification tests, e.g., identification, specific gravity, sieve analysis, consistency limits.	▪ Define, mention agricultural and geographical soils, hand pan. ▪ Clay, silt, sand, gravels, cobbles.	▪ Chalkboard/0-H ▪ Projector, Papers, Soft point, Chalk, Biro, Pencil, eraser, transparencies. ▪ Soils laboratory with relevant equipment of technology
	General Objective 6.0: Know about surface drainage and groundwater lowering.		
9	6.1 Describe surface drainage and wells. 6.2 Explain the method of lower in water in ground and wells. 6.3 Solve problems on all the above.	▪ Describe, Explain.	- do -
	General Objective 7.0: Know the principle of neutral and effective stresses.		
11 – 12	7.1 Use Piston and Spring analogy to substantiate neutral and effective stresses. 7.2 Sketch stress distribution in soils under concentrated and distributed load.	▪ Illustrate, Expose	- do -
	General Objective 8.0: Understand the crystal formation of soils using clay mineralogy		
13 – 15	8.1 Describe basic building units of clays. 8.2 Describe tetra- and Octa-building arrangements. 8.3 Explain the formation of two-layer soils with typical example like Kaolinite 8.4 Explain the formation of three – layer soils with typical example like montmorilloride. 8.5 Describe the soil chain. 8.6 Relate knowledge of clay mineralogy to Nigerian soils, e.g. Laterites etc. 8.7 Explain applications.	Describe, Explain, Relate.	All of above and possibly crystal models.

Competency: The student should understand basic geology for Civil Engineering works and have knowledge of the formation and classification of soils.
Assessment: Coursework 10%; Continuous tests 20%; Practicals 10%; Examinations 60%
References: 1. Terzghi, R. and Peck. "Soil Mechanics in Engineering Practice", John Wiley, N.Y.
2. Smith, R.C. "Elements of Soil Mechanics for Civil and Mining Engineers". Granada Publishers.

PROGRAMME: ND CIVIL ENGINEERING TECHNOLOGY			
Course: Engineering Geology and Basic Mechanics	**Course Code: CEC 108**	**Contact Hours: 2 – 0 – 3**	
Course Specification: Practical Content			
WEEK	**General Objective:**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 - 2	Describe geological and petrological specimens		Rock Specimens
3 - 6	Perform soil classification test: Specific gravity, sieve analysis, consistency limits (Atterberg Limits)	Technologist to prepare samples, equipment, and monitor students during the practical. He is to grade students reports and submit to lecturer. The course lecturer is to supervise the above activities and collate the results of the graded practicals.	Samples, specific gravity bottles, sieves, atterberg limit apparatus, tray, oven etc.
7 - 9	Identify various rocks, soils, and minerals and structural aspects of geology.		
10 - 12	Carry out water content and specific gravity experiments on solids		
13 - 14	Carry out grain size analysis using the manual and mechanical methods.		
15			
	Map exercises	- ditto -	Rock Specimens

PROGRAMME: ND CIVIL ENGINEERING TECHNOLOGY			
Course: Soil Mechanics I	**Course Code: CEC 212**	**Contact Hours: 2 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective: 1.0 Understand the principle of compaction and its determination in the laboratory and on site.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Explain compaction of soil. 1.2 State the different methods of compaction. 1.3 State the different forms of field control compaction characteristics. 1.4 Describe the three standard compaction tests. 1.5 Perform in the laboratory the three tests in 1.4 above	▪ Detailed presentation of BS, Standard, BS Heavy, Modified and WASC Compactions.	▪ Chalkboard, O-H Projector, chalk, writing tools, Standard Laboratory.
2	1.6 Describe a field compaction test. 1.7 Describe the type of equipment used for compaction movement of earth on site. 1.8 Explain how compaction plant is selected for different types of soils.	▪ Describe all field equipment, performances of output.	- do -
3	1.9 Explain the site compaction procedure. 1.10 Illustrate how to achieve site compaction control. 1.11 Describe field compaction tests (sand replacement and density balloon methods). 1.12 Perform field compaction tests.	▪ Explain/present.	- do -
	General Objective: 2.0 Know about California Bearing Ratio (CBR)		
4 5	2.1 Explain California Bearing Ratio. 2.2 State its use in relation to design of road pavement. 2.8 Design different layers of pavement using CBR values. 2.9 Conduct C.B.R. test.	▪ Explain, State, design. - do -	 - do -
	General Objective: 3.0 Know Darcy's Law and permeability in soil		
6	3.1 Explain the principles of hydrostatic and excess hydrostatic pressures, and hydraulic gradient. 3.2 Explain the principles of Darcy's Law 3.3 Describe the constant head and falling head permeameters. 3.4 Perform constant and falling head permeability tests. 3.5 Describe one method of measuring the permeability of a soil in the field (pumping tests).	- do -	- do -

	General Objective: 4.0 Understand Soil Stabilization		
7	4.1 Explain the different types of soil stabilization, (mechanical cement, lime, bitumen, etc).	▪ Explain, State, design.	▪ Chalkboard, O-H Projector, chalk, writing tools, Standard Laboratory.
	General Objective: 5.0 Know shear strength of soils and application to determination of bearing capacity		
8- 10	5.1 Write the Mohr-Coulomb shear strength equation defining all term in it. 5.2 Describe and conduct direct shear test. 5.3 Describe and conduct triaxial test (Drained and Undrained) 5.4 Perform the unconfined compression test. 5.5 Evaluate shear parameters (C, ∅) given the readings from 5.2,4.3 or 4.4. 5.6 Explain bearing capacities of soil. 5.7 Describe the applications of c and ∅ to the computation of bearing capacities.	▪ Define, explain, conduct tests.	- d o -
	General Objective: 6.0 Understand the earth pressure theories.		
11- 13	6.1 Explain active and passive pressures and earth pressure rest. 6.2 Describe Rankine's earth pressure theory. 6.3 Describe Coulumb's earth pressure theory. 6.4 Evaluate earth pressure using 5.2 and 5.3.	- do -	- do -
	General Objective: 7.0 Understand the compressibility and settlement of soils.		
14	7.1 Explain the types of settlement (immediate, consolidation and Creep). 7.2 Perform a consolidation test to determine the co-efficient of consolidation (C_v) the co-efficient of compressibility (m_v) and the compression index C_c.	- do -	- do -
15	7.3 Determine the amount of total consolidation settlement of a foundation using the results of 6.2.	▪ Perform calculations step by step.	- do -

Competency: The student should understand the application of Soil Mechanics to the design and construction of road foundations.
Assessment: Coursework 20%; Course test 20%; Examination 40%.
References: 1. Smith, R.C. "Elements of Soil Mechanics for Civil and Mining Engineers. "Granada Publishers.
2. Whitlow, R. "Basic Soil Mechanics". Harlow – Longman, 1995.

PROGRAMME: ND CIVIL ENGINEERING TECHNOLOGY			
Course: Soil Mechanics I	**Course Code: CEC 212**	**Contact Hours: 2 – 0 -3**	
Course Specification: Practical Content			
WEEK	**General Objective:**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 – 2	a. Perform a compaction test in the laboratory to obtain the maximum Dry Density and Optimum moisture content.	▪ Technologist prepare soil samples, equipment and monitor students during the practical. He should grade students reports and submit to course lecturer. ▪ Course lecturer is to supervise the above activities and collate the results of graded practicals.	▪ Compaction machine oven.
3	b. Conduct field density tests.	- ditto -	- ditto -
4 -5	c. Conduct californiа Bearing Ratio (CBR) test.	- ditto -	- ditto -
6 - 8	d. Carry out permeability tests using constant and falling head permeameters.	- ditto -	▪ Permeameters
9 – 12	e. Carry out direct shear and triaxial compression test to obtain (C and $\varnothing$)	- ditto -	▪ CBR machine ▪ Direct shear box machine ▪ Triaxal machine, rubber ▪ Oedometer ▪ Stop – watch
13 – 15	f. Carry out consolidation test (settlement vs square root of time) and obtain your consolidation coefficient C_v, Also obtain your compressibility (m_v) and the compression index C_c	- ditto -	- ditto -

STRUCTURES

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Structural Mechanics	**Course Code: CEC 101**	**Contact Hours: 1 – 1 – 0**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the equation of static equilibrium of structures.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define and draw free body diagrams. 1.2 Explain system of forces and types of loads (concentrated and uniformly distributed loads)	▪ Define, draw, explain, compute, use simple models.	▪ O/H projector, chalkboard, writing tools.
2 – 3	1.3 Compute reactions, moments, friction forces and equilibriants demanded by a system in equilibrium.		
4	1.4 Compute components of forces analytically and graphically		
	General Objective 2.0: Understand the kinetics of rigid bodies.		
5-6	1.13 State Newton's laws of motion. 1.14 Apply Newton's laws of motion to compute impulse, momentum and kinetic energy.	▪ State, apply, compose, resolve, ▪ Calculate.	- do -
7	1.15 Compose and resolve velocities and acceleration		
8	1.16 Make vector representation of velocities and acceleration.		
9	1.17 Calculate relative velocity and acceleration		
	General Objective: 3.0 Know analytical and graphical methods of determining member forces in roof and plant frames.		
10-12	3.1 Determine member forces by methods of joints, sections and tension coefficients.	▪ Determine, Apply, use simple models.	- do -
13	3.2 Repeat 3.1 above using graphical methods.		
14	3.3 Apply these methods to analyse simple planar roofs such as lattice girder, pratt and fink trusses.		

Competency: Students should be able to analyse problems in statics and dynamics of structures.
Assessment: Coursework 20%; Course tests 20%; Practicals 0%; Examination 60%.
References: 1. Tung, A.U. "Elementary Structural Mechanics". Prentice Hall Inc.
2. Cam, J.A. and Hulse, R. "Structural Mechanics." Mcmillan 1990.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Strength of Materials	**Course Code: CEC 106**	**Contact Hours: 2 – 1 –1**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the behaviour of materials at stresses below and above elastic limit.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Differentiate between the following: (a) Tensile and compressive stresses. (b) Tensile and compressive strains. (c) Define modulus of elasticity. 1.2 Explain stress - strain curves for: (i) brittle materials (ii) ductile materials. 1.3 Describe with illustration the elastic and plastic behaviour of common structural materials eg steel, concrete, timber, aluminium, plastic bamboo, soil.	▪ Differentiate, Explain, Describe.	▪ O/H projector, chalkboard, writing materials.
2	1.4 Give the strength ranges of the engineering materials listed in 1.3. 1.5 Explain proof stresses, working stress, direct stresses, safety factors, and lateral strains due to direct stresses. 1.6 Conduct tensile and compressive strength tests on steel and concrete, respectively, and determine their elasticity module.	▪ Present, Define, Explain	▪ Tensometer ▪ Plastic deflection ▪ Apparatus
3 4	**General Objective 2.0: Understand the properties of sections.** 2.1 Define and compute the centroids of sections e.g rectangular, I-section, T-sections, channel-section, and hollow sections. 2.2 Define and compute neutral axis. 2.3 Define and compute the first moment of area. 2.4 Define and compute the second moment of area (moment of intertia). 2.5 State and apply the 'Parallel axis theorem' in the computation of second moment of areas. 2.6 Define and compute the section modulus for simple and compound sections	▪ Define, Compute Apply.	
	3.1 Define shearing forces and bending moments with sign conventions. 3.2 Establish the relationship between the shearing force and bending moment.	▪ Use question and answer techniques ▪ Give assignments	▪ Shear force and bending moment apparatus

6 -7	3.3 Write expressions for shearing force and bending momemt at a section of a loaded beam. 3.4 Draw shear force and bending moment diagrams for any load beam (for various loading conditions)	▪ Lecture	- do -
8	3.5 Calculate the points of contraflexure	- do -	- do -
	3.6 Calculate the moment of resistance.	- do -	- do -
9	3.7 Compute moments, flexural and shear stresses each separately at a given point on a section. 3.8 Draw the stress distribution diagram at the section.	- do -	- do -
	General Objective 4.0: Understand the principles of deflection.		
10	4.1 Explain deflection 4.2 Calculate deflection of beams and protal frames using simple methods.	- do -	▪ Elastic deflection of beam apparatus ▪ Elastic deflection of frames
	General Objective 5.0: Understand the effect of torsion on circular section.		
11 - 12	5.1 Define torque, torsion, polar moment of interia, angle of twist, modulus of rigidty and shear stress. 5.2 Present the relationship between them. 5.3 Describe the torsion of the following circular sections: (a) thin tube (b) solid shaft (c) hollow shaft. 5.4 Determine the stress distribution on section of structural elements. 5.5 Compute the following for circular, rigid and hollow sections: (a) angle of twist, (b) torsional stress and (c) torsional stiffness.	▪ Use laboratory models	▪ Torsion meter ▪ Unsymetrical ▪ Cantilever apparatus
	General Objective 6.0: Understand the use of Mohr's circles.		
13	6.1 Describe Mohr's circles of (a) stress (b) strain.	- do -	- do -
14	6.2 Compute stresses and strains by Mohr's circles including the concept of principal stresses.	- do -	- do -

Competency: Students should be able to analyse problems in statistics and dynamics of structures.
Assessment: Coursework 20%; Course tests 20%; Practicals 10%; Examination 50%
References: 1. Joiner, J.H. "Strength of Materials".
2. Timoshenko, S.P. and Goodier, J.N. "Theory of elasticity". Mcgraw hill, 1970.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Strength of Materials	**Course Code: CEC 106**		**Contact Hours: 2 – 1 – 1**
Course Specification: Practical Content			
WEEK	**General Objective:**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	Conduct tensile and compressive strength tests on steel and concrete respectively and determine the elastic moduli.	▪ Technologist to be responsible for the preparation of samples and setting up of equipment, monitoring of students during the practical and grading of students practical reports. ▪ The course lecturer is to supervise the above activities and collect the results of the graded practicals.	▪ Universal testing machine, steel bar, venier calipers, steel tape, weighing machine. ▪ Concrete cube, ompression machine weighing machine.
2	Carry out elastic deflection of beams		
3 - 5	Carry out shear force and Bending moment experients		▪ Shear force apparatus. ▪ Bending moment apparatus.
6	Conduct experiments to illustrate deflection	▪	▪ Elastic deflection of beam apparatus. ▪ Deflection of beams apparatus ▪ Plastic deflection of frames ▪ Elastic deflection of frames. ▪ Torsion testing equipment.
7 - 8	Carry out unsymmetrical cantilever experiments.		
9 -11	Carry out deflection beam experiments.		
12 -13	Use portal frames apparatus		
14	Carry out torsion experiments.		

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Introduction to Structural Design	**Course Code: CEC 206**	**Contact Hours: 2 – 0 – 0**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the elastic, load factor and limit state methodology design in reinforced concrete elements.**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 Explain the evolution and application of codes of practice: NCP 1,2,3, CP3, CP114, CP110 and BS 8110. 1.2 Define slab, beam, column and foundation. Explain T and L beams. 1.3 Explain factor of safety.	▪ Explain, Define	▪ O/H Projector of Teaching tools
2 - 3	1.4 Explain the concepts of elastic theory, load factor and Limit state design.	- do -	- do -
4	1.5 Explain the different types of loading: dead, live/superimposed and wind loads. 1.6 Explain one way and 2 way slabs.		
5	1.7 Draw a structural layout of a typical floor slab and use it as a basis for load estimation. 1.8 Use the load estimated in 1.7 above to design a singly reinforced concrete slab and beam.	- do -	- do -
6	1.9 Define short and slender (long) column and axial loading		
	General Objective 2.0: Know the various types of foundation.		
7	2.1 Describe various types of foundations: (strip, pad, raft, combined, pile). 2.2 Illustrate the principles governing the choice of foundations.	- do -	- do -
8	2.3 Explain bearing capacity of soil and settlement of foundation. 2.4 Design spread or isolated footing for given load.	- do -	- do -
	General Objective 3.0: Understand simple structural steel design for tension, compression and flexure.		
9	3.1 Discuss the uses advantages and disadvantages of steel construction. 3.2 Describe the advantages and disadvantages of steel 3.3 Discuss fabrication of the various sections e.g UB, UC, L, rolled steel joists, hollow circular, hollow rectangular, channel, flats, sheets and plates, compound and built-up sections.	▪ Discuss, List, Sketch and Explain.	▪ O/H Projector, Chalkboard, Writing materials.
10	3.4 Explain the steps in the design of structural steel work. 3.5 Highlight the relevant codes for elastic and limit state design: BS 449, BS 5950 respectively.	▪ ▪ Explain, Highlight.	- do -

11	3.6 Explain the principle of bolted/revetted and welded connections and their modes of failure: i.e Shear, bearing and tearing.	▪ Explain.	- do -
12	3.6 Present fillet and butt welds. 3.7 Present the strength of riveted and welded joints.	▪ Present	- do -
13	3.9 Solve problems on the above topics.	▪ Solve	- do -

Competency: The students should design structural elements using codes of Practice..
Assessment: Coursework 20%; Course tests 20%; Practicals Nil; Examination 60%
Reference: 1. Bungey, J.H. and Mosley. "Reinforced Concrete design to BS 8110.
2. Macginley, T.J. and Ang, T.C. "Structural Steelwork Design". Butterworths, 1996.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Theory of Structures I	**Course Code: CEC 205**	**Contact Hours: 2 – 1 – 0**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Know the different methods of computing slope and deflection.**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1	1.1 Calculate member forces in simple frames using the tripod and shear legs coefficients - methods.	▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples	▪ Chalkboard ▪ Charts ▪ Drawing ▪ Design examples
2	1.2 Compute slope and deflection of simple beams and cantilever by double integration methods.	- do -	- do -
3	1.3 Compute slope and deflection of simple beams and cantilever by area- moment methods.	- do -	- do -
4	1.4 Compute deflection of simple frames using Williot-Mohr and analytical methods.	- do -	- do -
	General Objective 2.0: Know the principles for the stability of dams, retaining walls and chimneys		
5	2.1 Calculate over-turning moment, centres for given dams, retaining walls and chimneys.	- do -	- do -
6	2.2 Calculate sliding forces for given dams, retaining walls and chimneys.		
	General Objective 3.0: Understand interminancy in beams.		
7	Introduction to indeterminate Structures. 3.1 Define determinate, indeterminate structures and explain the concept of redundance. 3.2 Determine the degree of indeterminancy in beams and frame. 3.3 The use of coefficients for solving in determinate structure	- do - - do -	- do - - do -

Competency: The course is designed to enable the student analyse various mechanisms and structures.
Assessment: Coursework 20%; Course tests 20%; Practicals Nil; Examination 60%
References: 1. Adekola, A.O. "Mechanics of Statistically indeterminate structures" Mcmillan, Lagos.
2. Tung, a.U. "Elementary Structural Mechanics". Prentice hall Inc.

TRANSPORTATION

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Introduction to Highway Engineering	**Course Code: CEC 204**		**Contact Hours: 2 – 0 – 1**
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the necessity of providing highway or road for a community.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 Define a highway/road. 1.2 State the existing different road types in Nigeria 1.3 List the activities of a community that necessitate movement of persons and fright from place to place.	Lectures and demonstrations	Chalk and board
2	**General Objective 2.0: Know the history of development of Highway in Nigeria.**		
	2.1 Explain the evolution of road network. 2.2 Draw the main road network in Nigeria 2.3 Locate the various types of road in your area of operation. 2.4 State factors that affect road network growth and distribution.	Lectures and demonstrations	Chalk and board
3	**General Objective 3.0: Know the highway administration and financing in Nigeria**		
	3.1 List the different bodies responsible for road administration. 3.2 Produce a typical organisational chart for road administration. 3.3 Give the different finance sources for a road scheme. 3.4 Propose methods of generating revenue from a road scheme. (tolls, fuel levies vehicle licences, import and export)	Lectures and demonstrations	Chalk and board
4	**General Objective 4.0: Know the terms used in highway scheme.**		
	4.1 List the users of the road. 4.2 Give the vehicle, passenger and driver characteristics. 4.3 State the design data for a road stretch. 4.4 Layout highway schemes. 4.5 Interpret the highway schemes of your area of operation.	Lectures	Chalk
5 - 6	**General Objective 5.0: Understand the compaction of soils as a means of improving soil strength.**		
	5.1 Define soil compaction and consolidation. 5.2 Explain the soil strength, variation with varying degree of water content. 5.3 Describe methods of soil stabilization 5.4 Explain the three standard compaction tests.	Laboratory tests	- do -
	General Objective 6.0: Know the processes of pavement construction.		
7 - 9	6.1 Define various types of pavements 6.2 Explain the basic difference. 6.3 Describe the process of constructing a road base.		

	6.4 Explain the need for burrow-pits. 6.5 Describe the stages of road construction. 6.6 Explain the need for joints in rigid pavement construction. 6.7 Describe methods of joint protection. 6.8 Sketch the various types of joints in pavements. 6.9 Apply the sketch for construction works		
	General Objective 7.0: Know the equipment in road construction.		
10 – 11	7.1 List all the equipment and plants used in road construction (rigid and flexible). 7.2 Describe each equipment and its uses. 7.3 Describe each equipment in terms of economy cost, adaptability and versatility. 7.4 Describe methods of care and maintenance of equipment and plants. Explain safety precautions in the use of equipment.	- do	- do
	General Objective 8.0: **Know the materials for pavement construction.**		
12 – 13	8.1 List all materials used in pavement construction. 8.2 Describe the importance of each material. 8.3 Describe the sources of materials for pavement construction. 8.4 Describe methods of preparing materials. 8.5 Describe how each material is put into use. Use of the materials for pavement construction.	- do -	- do -
	General Objective 9.0: Know the procedure for pavement maintenance and repairs.		
14 - 15	9.1 List various types of pavement defects. 9.2 State causes of defects in pavements. 9.3 Describe methods of repairing defective pavements. 9.4 Explain the importance of early detection and repair of defects. 9.5 List the required equipment for pavement repairs and for the maintenance of pavement	- do -	- do -

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Introduction to Highway Engineering		**Course Code: 204**	**Contact Hours: 2 – 0 – 1**
Course Specification: Practical Content			
	General Objective: Conduct Practicals on topics in the theoretical content		
	Specific Learning Outcome:	**Teachers Activities**	**Resources**
2 – 5	Carry out the quality of mineral aggregates through laboratory experiments such as flakiness tests, crushing value tests, hardness test, impact test, angularity number of aggregation.	▪ Explain laboratory procedures. ▪ Assess and score results	▪ Flakiness apparatus, Abrasion machines, Crusing tests apparatus, angularity number aggregates.
6 – 7	Perform bitumen tests to determine bitumen quality, type and grades	▪ Explain flash point, softening point, ductility, Swell tests. ▪ Specify procedures. ▪ Assess and score results	▪ Say bolt furol apparatus other flash point apparatus, ball and Ring softening point apparatus, ductilometer, Swell test apparatus, bitumen.
8	Present to road construction procedures and equipment.	▪ Explain road construction trend and components.	▪ Road construction site with construction Equipment.
9 – 10	Produce trial mixes of plastic concrete.	▪ Design trial mix specific bitumen quality requirements. ▪ Explain to technologist and students. Specify procedure. Assess and score results	▪ Flash point equipment, peretrometer, ductilo meter, separators moulds.
11 –12	Carry out marshall stability and flow tests.	▪ Explain the need for the tests.	▪ Marshall stability equipment,
13 – 15	Compare with Hubbard-fields, HVeem and Smith tri-axial methods.	▪ Specify procedures. ▪ Assess and score results	flow test equipment. ▪ Hubbard-field, Hveem and Smith tri-axial apparatus.

Competency: Students are introduced to the rudiments of Highway Engineering focusing on simple highway construction and maintenance techniques.
Assessment: Coursework 20%; Course tests 20%; Examination 60%
Reference: 1. Salter, R.J. "Highway traffic analysis and design". Mcmillan 1996.

WATER COURSES

PROGRAMME: Civil Engineering Technology			
Course: Soil Science and Irrigation	**Course Code: CEC 208**	**Contact Hours: 1 – 0 – 3**	
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand the concept of soil science and irrigation**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1 2	1.1 Define soil (constituents, components) 1.2 State the soil parameters – colour, texture, structure, consistency, porosity, infilitration permeability etc. 1.3 Define irrigation and its uses.	▪ Lecture	▪ Chalk and board
	General Objective 2.0: Understand the interrelation of soil, moisture and plant		
3	2.1 Describe the movement of water in soils. 2.2 Determine the moisture content of soil. 2.3 Describe the various states of moisture in soils.	▪ Lecture	▪ Chalk and board
5	2.4 Explain crop-water requirements. 2.5 Test for soil-water relationship.		
	General Objective 3.0: Know the methods of application of water to soils.		
5 6 7 8 9	3.1 Describe the various methods of irrigation e.g. surface irrigation, sprinkled irrigation, drip irrigation, sub-surface irrigation. 3.2 State the factors that affect the choice of irrigation methods. 3.3 Describe the components and controls of each method of irrigation. 3.4 Define the following irrigation efficiency terms: i. Water storage efficiency ii. Water conveyance efficiency iii. Water distribution efficiency iv. Water application efficiency v. Consumptive use of water. 3.5 State the application of efficiency concept in the design of irrigation systems.	▪ Lecture and solve calculation based problems involving the various efficiencies. - do -	▪ Chalk and board - do -
	General Objective 4.0: Know the quality characteristics of irrigation water.		
10	4.1 Name the sources of irrigation water 4.2 State the desired quality range for acceptable (pH, chemical content, salts, etc.) 4.3 List possible impurities in irrigation water and their sources.	- do -	- do -

11 12	4.4 Define water logging 4.5 Determine solutions to water logging. 4.6 State possible irrigation hazards.	- do -	- do -
	General Objective 5.0: Understand the principles of field drainage and flood control.		
13	5.1 Define drainage. 5.2 Identify the needs for agricultural drainage. 5.3 Explain the methods of agricultural drainage. 5.4 Describe disposal methods of drainage water.	- do -	- do -
14	5.5 Determine the problems of flood and the need to find solution. 5.6 Identify different types of flood control structures. 5.7 Undertake drainage and flood control exercise in your state of operation.	- do -	- do -

Competency: The student is expected to know simple investigations necessary for irrigation projects.
Assessment: Coursework 20%; Course tests 20%; Practicals 10% Examination 50%
References: 1. Michael : Irrigation Engineering
2. ASCE : Irrigation Policies formulation and practices .

PROGRAMME: ND2: Civil Engineering Technology			
Course: Soil Science and Irrigation	**Course Code: CEC 208**	**Contact Hours: 1 – 0 – 3**	
Course Specification : Practical Content			
WEEK	**General Objective: Conduct Practicals to explain topics in the theoretical Content**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
5 6-7 8-9 10-11 12-13	Determine field soil moisture state through hand feel and observation methods Determine soil properties for Irrigation especially porosity and capillary water content. Determine moisture content of Irrigated crops and permanent wilting point. Observe Irrigation application methods. Identify drainage and flood control structures.	▪ Explain procedures for drying and weighing wet and dry samples ▪ Field visit to Irrigation sites	▪ Wet and dry soil samples ▪ Oven ▪ Scale balance ▪ Petre glasses ▪ Crops at different growth level ▪ Irrigation plots including fadama (river bed) plots.

Competency: The student is expected to know simple investigations necessary for irrigation projects.
Assessment: Coursework 20%; Course tests 20%; Practicals 10% Examination 50%
Reference: 1. Michael : Irrigation Engineering
2. ASCE : Irrigation Policies formulation and practices .

PROGRAMME: Civil Engineering Technology			
Course: Water Supply and Sanitary Engineering		**Course Code: CEC 202**	**Contact Hours: 2 – 0 -3**
Course Specification: Theoretical Content			
WEEK	**General Objective 1.0: Understand how to estimate water demand.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
1	1.1 State various uses of water. 1.2 Explain the hourly, daily and seasonal variations of demand 1.3 Identify the factors affecting water consumption. 1.4 Describe various methods of population prediction such as Arithmetic and Geometric methods	▪ Lecture and solve problems involving Arithmetic and geometric method of predicting population.	▪ Chalk and board
	General Objective 2.0: Know sources of water.		
2	2.1 Identify the various sources of water (stream, lakes, rain, underground) 2.2 Identify factors for sources selection.	▪ Lecture	▪ Chalk and board
	General Objective 3.0: Know the principles of intake design		
	3.1 Explain the different types of intakes 3.2 State principles of intake designs.	▪ Lecture and sketch various types of intakes.	▪ Chalk and board
	General Objective 4.0: Know the different type of pumps and their selections.		
3	4.1 Explain the need for pumping water 4.2 Describe different types of pumps 4.3 Recognise the criteria for pump selections. 4.4 Identify types of pumping stations 4.5 Prepare a plan of a pumping station. 4.6 Describe construction of pumping station.	▪ Lecture and solve problems involving pump efficiency and specific speed of a pump.	▪ Chalk, board, and pump.
	General Objective 5.0: Understand the basic water treatment processes.		
4 - 6	Explain the desirable standards of water for domestic and other uses – WHO and other standards 5.2 Explain the reasons for establishing these standards. 5.3 Describe surveillance and sampling techniques. 5.4 Explain methods of water analysis 5.5 Recognise the effect of pollutants in water. 5.6 Explain physico-chemical treatment methods 5.7 Define aeration, screen, and sedimentation and filtration. 5.8 Define coagulation and flocculation.	Lecture, solve calculation based problems. - do – Illustrate with sketches the break point chlorination	Chalk and board. - do -

	5.9 Outline different types of filtration such as slow sand filters, rapid sand filters and pressure filters. 5.10 Explain back washing operation 5.11 Describe basic principles of disinfection. 5.12 Describe different methods of disinfection and advantages and disadvantages of each method. 5.13 Distinguish between disinfection and sterilization 5.14 Define 'Breakpoint Chlorination' 5.15 Describe different methods of removing heavy metals from water 5.16 Explain how to control taste and odour.		
	General Objective 6.0:Understand the methods of storage and distribution of treated water.		
7 - 8	1 Describe the general layout of public water supply schemes. 6.2 Explain the purpose of service/storage reservoirs. 6.3 Name the types of water distribution system 6.4 Explain the need for water metering. 6.5 Recognise problems associated with the types of distribution systems. 6.6 Identify the types of pipe materials for water supply projects. 6.7 Describe different types of pipe beddings for laying of pipe. 6.8 Describe basic pipe networks. 6.9 Identify the types of joints, valves used and their functions. 6.10 Explain the functions of fire hydrants, washout chambers, thrust block etc. 6.11 Draw storage and distribution of treatment water plan.	▪ Lecture and solve problems involving pipe network of one or two loops only.	▪ Chalk and board.
	General Objective 7.0: Know the general principles involved in rural water supply.		
9	7.1 Identify different sources of rural water supply 7.2 Describe the different types of wells and their constructions. 7.3 Explain the treatment methods for rural water supplies 7.4 Draw rural water supply lines	▪ Lecture	▪ Chalk and board.

	General Objective 8.0: Know the sources and characteristics of waste water.		
10	8.1 Identify the sources of waste water 8.2 Define sewer, sewage and sewerage. 8.3 Explain the characteristics and composition of sewage. 8.4 Differentiate between pollution and contamination.	▪ Lecture	▪ Chalk and board
	General Objective 9.0: Understand basic methods and processes of sewage treatment.		
11-12	9.1 Describe physical treatment, 9.2 Describe chemical treatment 9.3 Describe biological treatment 9.4 Define primary sedimentation. 9.5 Describe the use of primary sedimentation 9.6 Describe major conventional treatment methods – activated sludge, trickling filters. 9.7 Explain aeration and its importance 9.8 Explain secondary sedimentation/clarification. 9.9 Describe the use of clarification. 9.10 Identify the advantages and disadvantages of the conventional treatment processes. 9.11 Explain flow diagram of the conventional treatment processes. 9.12 Explain stabilization ponds and aerated lagoons; their advantages and disadvantages. 9.13 Describe different types of on-site disposal systems such as septic tanks. 9.14 Explain methods of disposing septic tank effluents such as by soakaways, sub-surface irrigation and drainfield. 9.15 Define cesspool, aqua privy and pit latrines (including V.I.P latrine). 9.16 Draw all components of sewage treatment.	▪ Lecture and explain with the aid of schematic diagram of the various treatment process.	▪ Chalk and board
	General Objective 10.0: Know major sewer appurtenances		
	10.1 Explain what appurtenances are 10.2 Explain the following appurtenances i. Manhole ii. Building sewers/house connections and	▪ Lecture and sketch the vertical sections of the various appurtenances	▪ Chalk and board

13 - 14	iii. Siphons 10.3 Describe the different types of manholes 10.4 List the functions and objectives of manholes 10.5 Explain the following in relation to manholes: i. Spacing ii. frame and covers and iii. channel and benching 10.6 Identify the types of materials suitable for house connections 10.7 Describe the proper procedures for laying and making of house connections to sewers. 10.8 Identify the following as waste water measuring devices i. Weirs ii. Parshall flume iii. venturi flume 10.9 Explain the working of these devices 10.10 Draw the devices enumerated above. 10.11 Enumerate how to calculate discharges in the above devices.		
	General Objective 11.0: Understand the effects of pollution and the methods of control.		
15	11.1 Explain the concepts of water pollution 11.2 Identify the causes of tastes and odour in water. 11.3 Outline the effects of pollution on surface waters and groundwater. 11.4 Define eutrophication and self-purification. 11.5 Describe the causes of oxygen depletion in steams. 11.6 Explain the stratification of lakes and reservoirs. 11.7 Describe the effect of stratification on water quality.	Lecture	Chalk and board

Competency: Students exposed to activities of water supply industry waste water collection and disposal.
Assessment: Coursework 20%; Course tests 20%; Practicals 20% Examination 40%
References: 1. Chadwick, A.J. and Morfatt, J.C. "Hydraulics in Civil and Environmental Engineering" Rontledge, 1998.
2. Henry, J.G. and Heinke, G.W. "Environmental Science and Engineering" Prentice Hall, 1989.

PROGRAMME: ND1: Civil Engineering Technology			
Course: Water Supply and Sanitary Engineering		**Course Code: CEC 202**	**Contact Hours: 3 Hours/week**
Course Specification : Practical Content			
WEEK	**General Objective:**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
1- 12	1. Carryout experiments on water samples for colour, odour, taste, turbidity, acidity, alkalinity, hardness and heavy metals 2. Draw a plan of a pumping station 3. Draw a plan of rural water supply lines 4. Draw all the components of sewage treatment plant 5. Prepare plan and section drawing or sewers and manholes. 6 Estimate house hold demand of drinking water for a family. 7 Calculate simple head losses in pipe or in a pumping line.	▪ Technologist to supply the equipment under the supervision of the lecturer. ▪ Technologist to demonstrate the processes of analysis and students to follow. ▪ Lecturer to arrange for site visit to water supply and sewage treatment plants. Give assignments to students.	▪ PH meter, turbidometer, flame photometer and other water quality equipment, spectrophotometer. ▪ Drawing board, drawing pen, pencil, eraser, scale rule, set squares, T-square, drawing sheet. Ditto Ditto

Competency: Students exposed to activities of water supply industry waste water collection and disposal.
Assessment: Coursework 20%; Course tests 20%; Practicals 20% Examination 40%
References: 1. Chadwick, A.J. and Morfatt, J.C. "Hydraulics in Civil and Environmental Engineering" Rontledge, 1998.
2. Henry, J.G. and Heinke, G.W. "Environmental Science and Engineering" Prentice Hall, 1989.

PROGRAMME: Civil Engineering Technology			
Course: Technical Report Writing		**Course Code:** CEC 216	**Contact Hours:** 1-0-1
Course Specification : Theoretical Content			
WEEK	**General Objective:**		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	General Objective 1.0. Content of a Technical Report		
1 – 2	1.1 Explain the meanings of technical reports. 1.2 Identify the purpose of technical reports. 1.3 Explain types and uses of technical reports.	▪ Use questions and answer technique ▪ Give examples	▪ Chalkboard
	General Objective 2.0 Understand the methodology and sequence of writing technical report		
2 – 7	2.1 Discuss the methods of determining the following in technical reports. a. determination of topic and title. b. justification of title. c. abstract or synopsis of the report. d. aim and objectives of the report. e. classification of data. f. scope and limitation of project. g. Data analysis (Graphical method, tabular method descriptive method). h. Presentation of data (use of appendices) clear. i. Explain how it should be made and correct.	▪ Lecture ▪ Give assignments	- do -
	General Objective 3.0: Understand the information that is required in technical report writing		
7 – 14	3.1 Explain the various types of information that would be required in reports 3.2 Determine the factors that influence solutions. 3.3 Advance Civil Engineering conclusions arising from factors. 3.4 Select criteria required in case studies. 3.5 Determine critical analysis of case studies. 3.6 Produce summary. 3.7 Make propositions (Author's Propositions). 3.8 Develop conclusion to a technical report. 3.9 Write a bibliography in standard format. 3.10 Explain terms of reference in report.	- do -	- do -

	3.11 Explain the difference between facts and opinions. 3.12 Explain how facts and opinions may be distinguished in writing report. 3.13 Write reports on selected technical matters. 3.14 Rewrite the abstract.		

Competency: Students to acquire skills in technical report writing.
Assessment: Coursework 20%; Course tests 20%; Examination 60%

SIWES

STUDENTS' INDUSTRIAL WORK EXPERIENCE
PROGRAMME: ND CIVIL ENGINEERING TECHNOLOGY
COURSE: INDUSTRIAL TRAINING
DURATION: 4 MONTHS

TASK INVESTORY

GENERAL OBJECTIVES:

On completion of the Industrial Training Scheme, the students should be able to:

i. **Structural Engineering Experiences**
1. Understand the objectives and structure of the organisation.
2. Understand simple structural engineering drawing
3. Understand temporary works and acquire various skills in the use of Civil Engineering materials for building construction.
4. Understand the properties of cement and concrete and the different ways of storing cement.

ii. **Soil Mechanics & Foundation Engineering Experiences.**
5. Acquire skill in site investigations of soils for foundation.
6. Know various foundation construction method.

iii. **Highway Engineering**
7. Acquire practical skills in areas of surveying relevant to civil engineering.
8. Understand the processes of soil analysis and uses in highway construction.
9. Understand the production of concrete used in highway construction.
10. Understand the uses of tars and bitumen in highway maintenance.

iv. **Water and Waste Water Experiences**
11. Acquire basic skills in the analysis of water and waste water.
12. Know the construction processes of water and waste water structures.
13. Know the general procedure for data collection and the importance of contract documents.

v. **Log-Book and Supervision of SIWES**
14 Appreciate the importance of keeping accurate record of work experience.
15 Appreciate the importance of host company's monitoring SIWES students.
16 Appreciate the importance of polytechnic's supervision SIWES student as related to his professional training.

PROGRAMME: CIVIL ENGINEERING TECHNOLOGY			
Course: Industrial Training	**Course Code:**	**Duration: 4 Months**	
Course Specification: Theoretical Content			
	General Objective 1.0: Understand the objective and structure of the organisation		
	Special Learning Objective:	**Teachers Activities**	**Resources**
	1.1 List the objectives of the organisation. 1.2 Draw the organisation at chart/organogram of the company. 1.3 Maintain cordial relationship with the members of staff. 1.4 Make safe and adequate use of equipment, instruments, tools and materials 1.5 Put on appropriate clothing 1.6 Record and maintain a log-book of his day-to-day activities	▪ Supervise the students on monthly basis to check logbook in accordance with the expectations here ▪ Request and mark reports ▪ Grade report and submit SIWES officer	
	General Objective 2.0: Understand simple civil engineering drawing.		
	2.1 Draw and produce section of the following structural elements: beams, columns, slabs, stairs, strip foundation, pad foundation, retaining walls, simple roof trusses, and steel sections. 2.2 Trace structural drawings. 2.3 Trace architectural drawings. 2.4 Interpret simple architectural drawings 2.5 Interpret simple structural drawings. 2.6 Prepare bending schedules from structural drawings.		
	General Objective: 3.0 Understand the properties of cement and concrete and the different ways of storing cement.		
	3.1 Determine the initial and final setting time of cement. 3.2 Perform soundness test on cement. 3.3 Perform fineness test on cement and aggregates 3.4 Carry out conpressive strength test. 3.5 Participate in the construction of silos for storage of cement on large sites. 3.6 Observe the proper care and storage of bagged cement and aggregates.		
	General Objective 4.0: Understand temporary works and acquire various skills in the use of structural materials for building construction.		
	4.1 Use steel reinforcement in constructions.		

	4.2 Use different timbers for various jobs e.g shuttering roofing, strutting trenching etc. 4.3 Erect scaffoldings observing the necessary precautions. 4.4 Lay bricks and blocks correctly 4.5 Mix concrete. 4.6 Carry out concrete placement correctly. 4.7 Carry out concrete curing practice with various methods. 4.8 Determine workability of concrete by appreciate methods. 4.9 Perform insity tests such as slump, preparation of cube moulds etc.		
	General Objective 5.0: Acquire skills in investigations of soil for foundation.		
	5.1 Perform the following on soil with appropriate tolls and equipment for the analysis of the engineer: sieve analysis, hydrometer, liquid limit, plastic limit, shrinkage limit, soil bulk density, unconfined compression, field density, shear strength, penetrometer, bore hole dra-down and consolidation. 5.2 Draw curves and compute appropriate data for the above tests.		
	General Objective 6.0: Know various foundation construction methods.		
	6.1 Supervise excavation for foundations from working drawings. 6.2 Participate in the use of timbering for foundation construction. 6.3 Participate in dewatering processes at foundation sites e.g pumping and sub-soil drainage. 6.4 Prepare excavation bases for foundation construction. 6.5 Participate in various foundation construction works using appropriate techniques: sample foundations, strip, raft, isolated, and combined footings; driven piles, bored piles, short bored piles etc.		
	General Objective 7.0: Acquire practical skills in areas of surveying relevant to civil engineering.		
	7.1 Carry out jobs involving the use of the following instruments, chains, tape; ranging poles, optical squares, level; theodolites, total station, digital levels, EDM etc. 7.2 Carry out profile levelling and cross-sections 7.3 Extra setting out details and data from plan. 7.4 Set out frame work for bridges, drainage, building, roads, etc from known reference point. 7.5 Compute bearings and coordinates of points from horizontal angle measurements.		

	7.6 Reduce levels of various points. 7.7 Plot plans, cross-section, profiles and contours. 7.8 Determine areas and volumes from survey data.		
	General Objective 8.0: Understand the process and soil analysis in highway construction.		
	8.1 Get acquainted with the various earth moving plants within the Organisation. 8.2 Participate in the use of equipment in 8.1 above in carry out jobs. 8.3 Participate in location of borrow pits. 8.4 Collect soil samples. 8.5 Carry out the following tests: a. Classification(e.g grading, atterberg limits etc). b. Composition (iii) C.B.R. (Soaked and unsoaked). c. Site compaction control test (v) other geotechnique tests.		
	General Objective 9.0: Understand the production of concrete used in civil engineering works.		
	9.1 Produce different grades of concrete on site using various methods e.g manual, mixer, batching plant. 9.2 Carry out the following tests: slump test and cube test. 9.3 Use various methods to cure concrete on the site. 9.4 Participate in the construction of different types of formwork used on site e.g. smooth, wrought, swan, including steel form work. 9.5 Understand the different types of shutering used in highway works (e.g in culverts and bridges). 9.6 Read and interprete the bar bending schedule used in high way structures.		
	General Objective 10.0: Understand the uses of tars and bitumen in Civil Engineering Works.		
	10.1 Participate in jobs involving the use of different types of tars in highway construction 10.2 Observe the rate, spread and method of laying bituminous surface. 10.3 Carry out a visit to an asphalt production plant.		
	General Objective 11.0: Know the various highway structures and highway maintenance.		
	11.1 Participate in the construction of various highway structures e.g retaining walls, bridges, pipes and box culverts. 11.2 Read and interpret road signs and markings.		

	11.3 Maintain roads using appropriate equipment and tools.		
	General Objective 12.0: Acquire basic skills in the analysis of water and waste.		
	12.1 Carry out the following tests on water samples: a. Physical tests e.g colour, odor and TDS and taste. b. Chemical tests e.g hardness, salinity, PH etc. c. Bacteriological test e.g. coliform count. 12.2 Carry out biochemical test on waste water (BOD) and COD).		
	General Objective 13.0: Know the construction of water and waste water structure.		
	13.1 Perform setting out and excavation operation 13.2 Build formwork for placing concrete 13.3 Install pipes for water and waste water structures. 13.4 Carry out plumbing operations in buildings 13.5 Participate in drilling operations		
	General Objective 14. 0: Know the general procedure for data collection and the importance of contract documents.		
	14.1 Collect specific data using appropriate equipment on appropriate record sheets. 14.2 Analyse the data collected 14.3 Reproduce working drawings. 14.4 Interpret simple working drawings 14.5 Prepare simple bills civil engineering measurement and evaluation.		
	General Objective 15.0: Appreciate the importance of keeping accurate record of work experience.		
	15.1 collect design data: tables charts, standards and codes. 15.2 Collect sample drawings of projects for study and report writing. 15.3 Draw programme of works. 15.4 Obtain project cost estimates. 15.5 Collect equipment and instruments specifications. 15.6 Write concise report on training experience in good, simple and clear English.		
	General Objective 16.0: Appreciate the importance of host company's monitoring SIWES students.		
	16.1 Supervise training scheme of students. 16.2 Check reports during and after training duration 16.3 Comment on reports and performances of students 16.4 Scope student participation.		

	General Objective 17.0: Appreciate the importance of polytechnic supervision of SIWES student as relates to his professional training		
	17.1 Supervise training scheme. 17.2 Assess performance on training scheme: a. of student b. of host company 17.3 Grade the reports.		

GUIDELINES FOR ASSESSMENT OF ND STUDENT PROJECTS

PART A: SUPERVOSOR'S ASSESSMENT

Title of Project	
Name of Student	
Registration Number	
Course	

		Maximum Score	**Actual Score**
1	Presentation of Report(if conformity with standards)	6	
2	Understanding of the problem(s) and the pursuit of it to achieve the set objectives	7	
3	Report content(Data collection, Test procedures, Design/Construction, results and discussions)	12	
4	Does the report read as an integrated whole? (e.g. Details of work should be put in appendices)	12	
5	Quality of English(Sentence construction, grammar, spelling)	6	
6	Conclusion, Recommendations and summary	7	
	Total	**50**	

Brief Remark

_____

Name of Reader_____

Signature_____ Date_____

PART B: PANEL'S ASSESSMENT

Title of Project	
Name of Student	
Registration Number	
Course	

		Maximum Score	**Actual Score**
1	Presentation of Report(if conformity with standards)	10	
2	Report content(Data collection, Test procedures, Design/Construction, results and discussions)	20	
3	Knowledge of theory	10	
4	Conclusion and summary	10	
	Total	**50**	

Brief Remark

NATIONAL DIPLOMA AND HIGHER NATIONAL DIPLOMA

Guidelines for textbook writers

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

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

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

LIST OF MINIMUM RESOURCES

LIST OF PHYSICAL FACILITIES

Programme	**Laboratory**	**Workshop**	**Studio/Drawing** Room and Other
Civil Engineering Technology (ND)	1. Structures/Strength of Materials 2. Soil Mechanics and Concrete. 3. Hydraulics 4. Engineering Geology	1. Carpentry 2. Concrete/Building 3. Plumbing 4. Electrical/Mechanical	1. Drawing Room 2. Surveying & Geo-informatics Equipment Store 3. Computer Facilities/Laboratory 4. Photocopiers
	5. Structures	Ditto	Ditto
	6. Transportation	Ditto	Ditto
	7. Environmental Engineering	Ditto	Ditto
	8. Irrigation Water Management	Outdoor drainage and irrigation facilities	Ditto

LIST OF EQUIPMENT

CIVIL ENGINEERING TECHNOLOGY

LIST OF LABORATORY EQUIPMENT

S/No	Structures/Strength of Materials – ND	No. Required
1.	Torsion testing machine	1
2	Plastic bending of Portal frames	1
3.	Two hinged and Three-hinged arch apparatus	1
4.	Continuous beam apparatus	1
5.	Deflection of beams apparatus	1
6.	Bending moment and shearing force apparatus	1
7.	Elastic beam apparatus	1
8.	Elastic deflection of frames	1
9	Strut buckling apparatus	1
2.	**A. Soil Mechanics and Laboratory (ND)**	
1.	C.B.R. Apparatus	1
2.	Consistency limits test apparatus	6
3.	Compacting factor machine	1
4.	Compacting core machine	1
5.	Particle size distribution test apparatus (manual and electrical –sieve shaker)	2 set
6.	Compaction test apparatus	3 standards
7.	Core penetrometer	1
8.	Moisture content text apparatus	2
9.	Specific gravity test apparatus	3
10	Density test apparatus	3
11.	Le Chatelier test apparatus	2
12.	Augers and rings with sampling & extruding devices	5
13.	V-b consistometer text apparatus	1
14.	Drying ovens	3
15.	Sampling collecting trays and sample containers	20
16.	150mm cube moulds	18
17.	150mm cylindrical moulds	18
18.	Balances e.g analytical balance triple beam Balance, top pan-balance, semi-automatic	

	Balance, spring balance, chemical balance, electrical balance	2 of each
19.	Vicat apparatus	2
20.	Thermometers	5 of each
21.	Measuring cylinders	5
22.	Cement fineness test apparatus	2
23.	Soil hydrometers	3
24.	Crucibles, spatulas, funnels	5
25.	Dessicators	6
26.	Curing tank	1
27.	Stop watches	10
28.	Beam moulds	4
29.	Crushing machine	1
30	Vernier calipers	2
31	Glass wares	Assorted
32	Schudt rebounce harnmer	2
S/No	**2. Additional Equipment Required for HND**	**No. Required**
1.	Consolidation test apparatus	1
2	Triaxial compression apparatus	1
3.	Unconfined compression text apparatus	1
4.	Extensometer (universal-shear compression)	1
5.	Direct shear box test apparatus	1
6.	Laboratory vane test apparatus	1
7.	Permeability test apparatus	1
8.	Constant and falling head permeability cell	1
9	Soil pulverizer	1
2.	**3A Hydraulics and Hydrology (ND)**	
1.	Hydraulic benches	Assorted
2.	Stability of floating bodies apparatus	1
3.	Discharge through the orifices	1
4.	Flow through venturimeter	1
5.	Discharge over a notch	1
6.	Friction loss along a pipe	1
7.	Impact of jets	1
8.	Centre of pressure apparatus	1
9.	Flow visualization	1
10	Losses in piping systems	1
11.	Windage counter	1
12.	Evaporation gauge	1

13.	Hydrology apparatus	1
14.	Hydrostatic and properties of fluids	1
15.	Laminar/turbulent flow pipe	1
16.	Current meters	1
17.	Point and hook gauge	2
18.	Rain gauges	1
19.	Water tank	1
20.	Barometer piezometer	1
21.	Falling head permeameter constant head permeameter	1
22.	Hydrometer	1
23.	Surge tank demonstration set	1
24.	Simple weather equipment e.g wind vane infiltrometer	2 each
25.	Pitot tube	2
26.	Float	Assorted
27.	Stop waters	5
28.	Measuring tapes	5
29.	Meteorological station	1
30	Rain fall simulator	1
31	Water Hammer apparatus	2
S/No	**3 B. Additional Equipment Required for HND**	**No. Required**
1.	More hydraulic benches	Assorted
2.	Flow channel	1
3.	Flow measuring apparatus	1
4.	Reynolds number 8 transitional flow	1
5.	Centrifugal pump test rig	1
6.	Model sedimentation tank	1
7.	Liquid sedimentation	1
8.	Permeability tank	1
9.	Bernoll's theorem demonstration apparatus	1
10.	Hydraulic ram	1
11.	Series/Parallel pump test	1
12.	Pump characteristics text accessories	1
13.	Osborne Reynolds apparatus	1
14.	Air flow rig	1
15	Drag coefficients of particles apparatus	1
16	Flow meter demonstration apparatus	1
17.	Pipe surge and water Hammer apparatus	1
18.	Drainage seepage tank	1

19.	Standard 300mm wide tilting flow channels and models	1
20	Ground water flow	1
21.	Raingall hydrographs.	1
22.	Hydraulic models	
	4 Structures Laboratory for HND	
1.	Universal testing machine (100) and complete accessories	1
2.	Stand magnus apparatus	1
3.	Three-hinged arch apparatus	1
4.	Deflection of curved bars	1
5.	Model frame work apparatus	1
6.	Deformation of rings, squares and rectangle apparatus	1
7.	Plastic bending apparatus	1
8.	Universal testing frame apparatus and accessories	1
9.	Suspension bridge apparatus	1
10	Unsymetrical cantilever testing apparatus	1
11.	Shear center apparatus	1
12.	Audio-Visual aids	Assorted.
13.	Deflection of an Eccentric tie	1
14.	Strength of Timber beams.	1
	Transportation Laboratory (For HND) **A. Traffic engineering equipment**	
1	Rader and enoscope for 5 speed studies	4
2	Measuring tapes and stop watches	6
3	Warning flares and cones	6
4	Ranging rods.	6
S/No	**B Asphalt Laboratory**	**No. Required**
1.	Standard penetration text apparatus	1
2	Kinematic capillary viscosity text apparatus	1
3.	Saybelt fuel viscosity test apparatus	1
4.	Cleveland open cup flash point text apparatus	1
5.	Ductility text apparatus	1
6.	Distillation text apparatus	1
7.	Float text apparatus	1
8.	Loss angeles abrasion text apparatus	1
9.	Marchall stability and flow text apparatus	1
10.	Hveen stabilometer test apparatus	1
11.	Hveencohesiometer text apparatus	1
12.	Hubbard field apparatus	1

13.	Swell test apparatus	1
14.	Softening point apparatus (ring and ball)	1
15.	Penetration text apparatus	1
16.	Tally counter	6
17.	Aggregates impact and crushing values apparatus	1
18.	Binder extraction apparatus	2
19.	Hot plate	2
20.	Benkelman beam	1
21.	Temperature bath	2
22.	Dessicators	5
23.	Water tank	1
24.	Thermometer	Assorted
25.	Oven	Various ranges
	6. A. Water & Waste Water Treatment laboratory (For HND)	
1.	Chlorine determination apparatus e.g Lovibond 1000 comparator	1
2.	Acidity and alkalinity apparatus	1
3.	Aluminium apparatus	1
4.	Iron determination apparatus e.g Hack kit IR 18B Merck text strips	1
5.	Silica determination apparatus	1
6.	Dissolved oxygen apparatus	1
7.	Oxygen demand apparatus	1
8.	Phosphate apparatus	1
9.	Nitrogen apparatus	1
10.	Turbidity apparatus	1
11.	Manganese apparatus	1
12	Hardness apparatus	1
13	Carbon-dioxide apparatus	1
14	Colour apparatus	1
15	Ozone apparatus	1
16	PH determination apparatus	1
17	Phenol apparatus	1
18	Odour and taste apparatus	1
19	Bacteriological analysis apparatus	15
20	Bottle with stoppers	15
21	Weight bottles with stoppers	15
22	Robber tubes	15
S/No	**Water & Waste Water Treatment laboratory (For HND)**	**No. Required**
23.	Automatic sampler e.g peristaltic pump diaphragm pump	Assorted

24.	Filterability index apparatus	1
25.	Deep-bed filter column	1
26.	Permeability/Fluidisation apparatus	1
27.	Ion-exchange apparatus	1
28.	Aeration apparatus	1
29.	Flocculation text apparatus	1
30.	Sedimentation study apparatus.	1
31	Flame photo meter	1
32.	Atomic Absorption spectrophotometer	1
33.	Spectrophotometer meter	1
34.	Electronic Balances	2
35.	Microscopes	5
36	Oven	3
37.	Refrigerator	2
38.	Inembatory	2
39.	Petri-dishes	various
40.	Glass wares	various
41.	Pi-pumps	10
	6. B Irrigation Water Management Laboratory (For HND)	
1	Open channels, distributors and measuring devices	1
2	Sprinkler infiltrometer	1
3	Sprincler testing rig	1
4	Surface drainage field demonstration	1
5	Demonstration sand table	1
6	Rainfall simulator’	1
7	Surface Irrigation model	1
8	Gauging weirs and flumes	1
9	Gauging and control structures	1
10	Test channel section	1
11	Demonstration Iysimeter	1
12	Irrigation equipment displays	1
13	Demonstration infliltration apparatus	1
14	Field drain filter test apparatus	1
15.	Outdoor Irrigation and drainage field	1
	6 C Engineering Geology Laboratory	
1	First aid box	1
2	Shower	1
3	Fire extinguisher	2

4	Fire buckets	2
5	Safety charts and drawings	Assorted
6	Safety codes and standards	Assorted
7	Goggles	30
8	Protective clothing	30
9	Fire hydrains	
10	Geological maps	Assorted
11	Specific gravity test apparatus	5
12	Balances	5 various
13	Microscopes	2
14	Microscopes with camera	1
S/NO	**COMPUTER & GIS LABORATORY**	**QUANTITY**
	hard wares	5
1	Pentium Base Computers	2
2	10 second Total Station Accessories	1
3	3 Seconds Total Station & Accessories(HND)	1 pair
4	Handheld GPS(HND)	1
5	EDM(HND)	1
6	Digital Theodolite	1
7	Printers	3
8	Digitizers A3 (HND)	1
	Softwares	
1	DBMS	
2	SURFERS	
3	MAPMAKERS	
4	LOTUS/EXCEL	
5	Wordprocessing	
5	AUTOICAD	
6	ILWIS	
7	ARCVIEW/ARCINFOR	
	SURVEYING EQUIPMENT STORE	
1	Levelling Instruments	1 each
2	Theodolite	2
3	Compasses with tripods	3
4	Mirror Stereoscope (HND)	3
5	Pantograph	2
6	Staves	5

7	Ranging Poles	20
8	Surveying Umbrella	6
9	Chains	5
10	Steel arrows	15
11	Planimeters	3
12	Tapes(30m, 50m, 100m)	5 each
13	Optical square	3
14	Pocket altimeter	2
15	Steel band	3

LIST OF WORKSHOP EQUIPMENT

1. **CARPENTRY WORKSHOP**

S/No	Planes and Saws	No. Required
1	Jack planes	3
2	Smoothing planes	3
3	Block planes	3
4	Shoulder planes'	3
5	Multi-Plough plane	3
6	Rebate plane	3
7	Grooving/Plough plane	3
8	Bull nose plane	3
9	Compass plane	3
10	Jointing plane	3
11	Side rabbet plane	3
12	Rip saw	3
13	Cross cut/hand saw	3
14	Tenon saw	3
15	Panel saw	3
16	Coping saw	3
17	Nest of saws/compass saw	3
18	Key-hole saw	3
19	Bracket or Fret saw	3
20	Band saw	3
	Chisels	
21	Ordinary firmer (set) 3mm, 6mm, 12mm, 18mm and 25mm.	2
22	Bevel-edge firmer (set)	2 each of 6mm
23	Pairing bevel-edge (set)	2 each 6-9mm, 12mm
24	Mortice (set)	3
25	Firmer gauge (set)	3
26	Pairing firmer (set)	3
27	Turning chisels (set)	3
	Bits	
28	Centre (set)	2
29	Auger (set)	2
30	Twist (set)	2
31	Counter-sink (set)	2

32	Rose (set)	2
33	Gimlet	2
	Driving/striking Tools	
34	Screw driver (set of 6)	2
35	Mallet	2
36	Claw hammer	2
37	Pane hammer	2
38	Warington hammer	2
39	Bradawl	2
	Cramps	
40	Sash (set)	2
41	Gee (‘G’) cramp	2
41	Corner	2
43	Bench hold fast	2
44	Circular saw bench	1
45	Surtacer	1
46	Wood lathe with accessories	1
47	Band saw	1
48	Spindle moulder	1
49	Radial circular saw	1
50	Compressor and spraying unit	1
51	Thicknessing machine	1
52	Tenoning machine	1
53	Mortiser (chisel and chain)	1
54	Sanders (drum, disc and belt)	1
55	Dimension saw	1
56	Drilling machine	1
57	Jig saw	1
58	Press (school size)	1
	Utilities	
59	Work benchs	15
60	Tool trolleys	4
61	Hangers for dresses	35
	A/V	
62	Magnetic board	1
63	Flannel board	1
64	Display board	1

65	Overhead projector and transparencies	1
66	Slide projector	1
67	Film strips projector	1
68	Opaque projector	1
69	Projector screen	1
	Dressing	
70	Overalls (aprons-brown)	35
71	Goggles	35
	Chalkboard	
72	T. Square	2
73	Set square 60/75	2
74	Compasses	2
75	Protractors	2
76	Duster	2
77	Ruler (metre rule)	2
	Powered Hand Tools	
78	Blower	2
79	Sprayer	5
80	Grinding machines	2
81	Sharpening machines	1
82	Grinding stone	1
83	Oil cans	2
84	Grinder for long blades e.g surface planer	1
85	Paint brushes (sets)	5
86	Putty knives	5
87	Paint containers	5
88	Glue pot-2 jackets (for animal glue)	2
89	Glue spreader	1
90	Glue brushes – various sizes	2 each
91	Marking gauge	3
92	Mortice gauge	3
93	Cobine gauge	3
94	Cutting gauge	3
95	Marking knives	3
96	Verneer knives	3
97	Try square	3
98	Mitre square	5
99	Four fold wooden ruler metric	5

100	Measuring tapes metric	10
	2. Concrete/Block-laying Workshop	
1	Portable compressor and accessories	1
2	Bar bending machine	1
3	Steel cutter	1
4	Mesh/BRC cutter	1
5	Concrete vibrator: poker and table vibrators	1
6	Hand rammers	4
7	Concrete portable mixer (at least 2 cu. Ft. capacity)	1
8	Brick/block making machine	1
9	Wheel barrow	5
10	Watering can	5
11	Shovels	15
12	Head pan	10
13	Brick saw	1
14	Concrete nail gun	1
15	Hand tools, e.g spirit levels, trowels, hammers, rules, squares, mallet, tapes, floats etc.	Assorted
16	Multiflow mixer	1
17	Cement box	5
18	Aggregates and sand box	5
19	Slump cones	5
20	Concrete crushing machine	1
	3. Plumbing/Mechanical Workshop	
1	Guillotine (three feet)	1
2	Fittings	Assorted
3	Pumps various types (e.g centrifugal, reciprocating pump, series and parallel	
4	pumps, submeersives etc)	1 each
5	Valves, surge tanks, water hose	
6	Pipe bending machine	Assorted
7	Light duty drilling machine	1
8	Table drilling machine	1
9	Sheet metal folding machine	1
10	Tapping machine forge	1
11	Arc welding machine	1
12	Oxy-acetylene equipment	5
13	Acetylene generator	1
14	Electric soldering tool	1

15	Refix hydraulic pipe bender	1
16	Grinding machine	10
17	Jack pump	10
18	Pipe standing vices	1
19	Table vices	1
20	Copper tube bender	1
21	Copper bit	1
22	Hacksaw	10
23	Boxwood bending dresser	6
24	Share hooks	6
25	Tin snips	6
26	Hacking knife	6
27	Gimlet for lead pipe and wood screws	1
28	Wrenches	Assorted
29	Dies	Assorted
30	Pipe and bolt threading machine	1
31	Files	Assorted
32	Rules	Assorted
33	Tapes	5
34	Wheel cutter	5
35	Compound and combination type water meters	5 each
	4. Electrical Workshop	
1	Bending vices/machine	10
2	Accumulators	2
3	Electrical tool kits	4
4	Battery charging equipment	1
5	Soldering iron and equipment	10
6	Generators	1
7	Avo meters	2
8	Ammeters	2
9	Volt-meters	2
10	Writing boards	Assorted
11	Consumer units:	
	a. Circuit breakers	Assorted
	b. Distribution box	2
	c. Outlets and plugs and switches	Assorted
	d. Meters	3 types
	e. Mains switchs	Assorted

	II Studio/Drawing Room	
1	Drawing table	35
2	T-Square	3
3	Set square	3
4	Drawing pen	3
5	Chalkboard set square	2 sets
6	Chalkboard protractors	2
7	Chalkboard divider	2
8	Chalkboard pair of compasses	2
9	Chalkboard wooden straight edges	2
10	Chalkboard lettering set	2 sets
11	Drafting machine for standard drawing table	4
12	Templates	2 sets
13	Plastic curves	2 sets
14	Railway curves (metric) set	2 sets
15	Projector	1
16	Electronic calculators	20
17	Standard drawing boards (imperial size)	30
18	Engineering scale rules	Assorted 10 eacg
S/No	**Duplicating and Printing Room**	**No. Required**
1	Photostating machine	1
2	Plan printing machine	1
3	Duplicating machine	1
4	Trimming machine	1
5	Scanning machine	1
	Safety Equipment (for each Workshop)	
1	First aid box	1
2	Safety goggles	32
3	Safety caps	32
4	Rubber boots	32 pairs
5	Leather apron	32
6	Leather palm gloves	32 pairs
7	Fire extinguisher	2
8	Fire buckets	2
9	Safety charts and drawings	Assorted
10	Shower	1

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

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