

NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA



CURRICULUM AND COURSE SPECIFICATION

FOR

NATIONAL DIPLOMA

IN

WATER RESOURCES ENGINEERING TECHNOLOGY

DEVELOPED IN COLLABORATION WITH

NATIONAL WATER RESOURCES INSTITUTE, KADUNA

JULY, 2014

General Information

1.0 CERTIFICATION AND TITLE OF THE PROGRAMME:

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

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

2.0 GOALS AND OBJECTIVES

The National Diploma Programme in **Water Resources Engineering Technology** is aimed at producing technicians with good knowledge and skills needed in executing water related engineering works, who can be self-establishing and self-reliant in the water sector.

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

- i. Collect data for Water Resources Engineering projects and processes
- ii. Assist to produce and interpret Water Resources Engineering drawings and schedules
- iii. Assist in the supervision of Water Resources Engineering Projects and processes
- iv. Carry out necessary Engineering tests related to Water Resources projects
- v. Interpret surveyor's measurements
- vi. Assist in setting out Water Resources Engineering construction projects
- vii. Carry out maintenance of Water Resources Engineering works
- viii. Assist in carrying out Water Supply, Sanitation and Hygiene (WASH) related activities.

3.0 ENTRY REQUIREMENTS:

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

- S.S.C.E or its equivalent (NTC, WASC, G.C.E, NECO) with five(5) credits in **Mathematics, English Language, Physics, Chemistry**, and one other science subject (i.e. **Biology, Agricultural Science, Geography, and Economics**) at no more than two sittings. In addition

credit or pass in any of the following subjects will be an advantage: *Wood Work, Metal Work, Auto-mechanics, Basic Electronics, Basic Electricity, Building Construction, Technical Drawing, and Fine Art.*

4.0 CURRICULUM

4.1 The curriculum of the ND programme consists of five main components, which are:

1. General Studies/Education
2. Foundation Courses
3. Professional Courses
4. Students' Projects.
5. SIWES

4.2 The General Education component shall include courses in:

- Art and Humanities - English Language, Communication Skills, Library studies
- Social Science - Citizenship, Sociology, Economics, Entrepreneurship, Management, Engineer in Society.

This component shall account for not more than 5% of total contact hours for the programme.

4.3 Foundation Courses include courses in:

- Mathematics
- Pure Sciences
- Computer Applications
- Technical Drawing
- Descriptive Geometry
- Statistics.

The number of hours will vary with the programme and may account for about 10-15% of the total contact hours.

4.4 Professional Courses are courses which give the student the theory and practical skills he requires to practice in his chosen field at the technician level. These may account for between 70-80% of the contact hours depending on the programme.

4.5 The student's projects shall be taken and graded during the second year of the programme.

5.0 CURRICULUM STRUCTURE

The structure of the ND programme consists of four semesters of classroom, laboratory and workshop activities and a student project. Each semester shall be of 17 weeks duration made up as follows:

- a) 14 contact weeks of teaching, i.e. lectures, practical exercises, and educational visits and
- b) 3 weeks for tests, quizzes, examinations and registration.

6.0 PROJECT

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

7.0 ACCREDITATION

The programme offered shall be accredited by the National Board for Technical Education (NBTE) before the diplomates shall be awarded the diploma certificate. Details about the process of accrediting a programme for the award of ND are available from the Executive Secretary, NBTE, Kaduna.

7.0 CONDITIONS FOR THE AWARD OF THE ND

The Institution will award the National Diploma to candidates who successfully complete the programme after passing prescribed course work, examinations, and the student project. Such candidates should have completed a minimum of between 90 and 100 semester credit units. National Diploma Certificates shall be awarded based on the following classification:-

<i>Distinction</i>	-	<i>CGPA 3.50 - 4.00</i>
<i>Upper Credit</i>	-	<i>CGPA 3.00 - 3.49</i>
<i>Lower Credit</i>	-	<i>CGPA 2.50 - 2.99</i>
<i>Pass</i>	-	<i>CGPA 2.00 - 2.49</i>

8.0 GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME

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

8.2 In designing the units, the principle of the modular system by product has been adopted; thus making each of the professional modules, when completed, provide 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 integrated. Practical exercises, especially those in professional courses and laboratory works 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 contents.

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 of 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, cognizance 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.

COURSE OUTLINE

GENERAL STUDIES COURSES

1. Communication Skills I
2. Communication Skills II
3. Citizenship Education I

MATHEMATICS COURSES

4. Algebra and Elementary Trigonometry
5. Introduction to Statistics
6. Calculus

7. Trigonometry and Analytical Geometry

SURVEYING AND GEOINFORMATICS

8. Principles of Surveying
9. Engineering Surveying I

INFORMATION & COMMUNICATION TECHNOLOGY

10. Introduction to Computing
11. Introduction to Computer Programming

DRAWING

12. Technical Drawing
13. Descriptive Geometry
14. Civil Engineering Drawing I

CONSTRUCTION

15. Water Engineering Construction
16. Construction of Hydraulic Structures
17. Drilling Technology

MANAGEMENT

- 18. Introduction to Entrepreneurship
- 19. Practice of Entrepreneurship
- 20. Introduction to Technical Report Writing

WORKSHOP PRACTICE

- 21. Workshop Technology I

ENGINEERING MEASUREMENT AND SPECIFICATION

- 22. Engineering Measurement and Evaluation

HYDRAULICS AND HYDROLOGY

- 23. Introductory Fluid Mechanics
- 24. Introductory Hydrology
- 25.
- 26. Hydraulics
- 27. Hydrometeorology
- 28. Hydrometry

SOIL MECHANICS / GEOLOGY

- 29. Introduction to Geology
- 30.
- 31. Basic Soil Mechanics
- 32. Soil Mechanics I
- 33. Hydro-geology

STRUCTURES/MATERIALS

- 34. Engineering Mechanics
- 35. Strength of Materials
- 36. Science and Properties of Materials
- 37. Introduction to Structural Design
- 38. Theory of Structures I

WATER

39. Introduction to Water Resources Engineering
40. Introduction to Water Supply and Waste Water Technology
41. Hygiene and Sanitation Promotion
42. Plumbing Works and Network Distribution
43. Irrigation and Drainage
44. Water Quality Assessment
- 45.

Student's Industrial Works Experience Scheme (SIWES)

Guidelines for assessment of ND Students Projects

Guidelines for ND Textbook writers

List of Minimum Resources

List of Equipment

List of Participants : Expert Group Meeting

CURRICULUM TABLE**NATIONAL DIPLOMA****YEAR ONE : SEMESTER ONE**

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
WRE 107	Principles of Surveying	1	0	4	5	5	
MEC 112	Technical Drawing	1	0	3	4	4	
WRE 101	Engineering Mechanics	2	0	1	3	3	
WRE 113	Workshop Technology I	0	0	4	4	4	
WRE 103	Water Resources Engineering Construction	2	0	2	4	4	
MTH 112	Algebra and Elementary Trigonometry	2	0	0	2	2	
CEC 107	Introduction to Fluid Mechanics	1	0	2	3	3	
STA 111	Introduction to Statistics	2	0	0	2	2	
GNS 101	Communication Skills I	2	0	0	2	2	
GNS 111	Citizenship Education I	2	0	0	2	2	
WRE 105	Introduction to Water Resources Engineering	2	0	0	2	2	
	TOTAL	17	0	16	33	33	

YEAR ONE: SEMESTER TWO

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
MEC 102	Descriptive Geometry	1	0	2	3	3	
WRE 102	Introductory Hydrology	2	0	1	3	3	
CEC 104	Science and Properties of Materials	2	0	2	4	4	
CEC 106	Strength of Materials	2	1	1	4	4	
WRE 104	Introduction to Geology	2	0	1	3	3	
WRE 106	Plumbing and Distribution Network	1	0	2	3	3	
MTH 211	Calculus	3	0	0	3	3	
GNS 102	Communication Skills II	2	0	0	2	2	
EEd 126	Introduction to Entrepreneurship	1	0	2	3	3	
WRE 108	Basic Soil Mechanics	2	0	1	3	3	
ICT 119	Introduction to Computing	1	0	2	3	3	
	TOTAL	19	1	14	34	34	

YEAR TWO: SEMESTER ONE

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
SUG 208	Engineering Survey I	1	0	3	4	4	WRE 107
WRE201	Hydraulics	2	0	1	3	3	CEC 107
WRE 207	Hydrometeorology	1	0	1	2	2	WRE 102
CEC 205	Theory of Structures I	2	1	0	3	3	CEC 106
CEC 207	Hydro-Geology	1	0	1	2	2	
CEC 209	Civil Engineering Drawing I	1	0	3	4	4	MEC 102
WRE 205	Construction of Hydraulic Structures	2	0	2	4	4	MTH 112
MTH 122	Trigonometry and Analytical Geometry	2	0	0	2	2	-
EEd 216	Practice of Entrepreneurship	1	0	2	3	3	-
WRE 209	Introduction to Technical Report Writing	2	0	0	2	2	ICT 119
COM 113	Introduction to Computer Programming	2	0	2	4	4	
	TOTAL	17	1	15	33	33	

YEAR TWO : SEMESTER TWO

Course Code	Course Title	L	T	P	CU	CH	Pre-requisite
WRE 200	Project	0	0	3	3	3	
WRE 202	Introduction to Water Supply & Waste Water Technology	2	0	3	5	5	
WRE 204	Hygiene and Sanitation Promotion	2	1	1	4	4	
CEC 206	Introduction to Structural Design	2	0	0	2	2	
CEC 212	Soil Mechanics I	2	0	3	5	5	WRE 108
WRE 206	Irrigation and Drainage	2	0	1	3	3	
WRE 208	Engineering Measurements, Evaluation & Specifications	2	0	0	2	2	
WRE 210	Water Quality Assessment	1	0	2	3	3	
WRE 212	Drilling Technology	2	0	2	4	4	
WRE 214	Hydrometry	1	0	2	3	3	WRE 102
	TOTAL	16	1	17	34	34	

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 107	Contact Hours: 1 – 0 - 4
Subject/Course: Principles of Surveying		Theory: 1 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 4 hours/week

<p>General Objectives</p> <p>1.0 Know fundamental concepts of surveying</p> <p>2.0 Appreciate surveying trigonometry</p> <p>3.0 Know basic survey drawing techniques</p> <p>4.0 Understand leveling</p> <p>5.0 Know traversing</p> <p>6.0 Know triangulation</p> <p>7.0 Know tachometry</p> <p>8.0 Understand the procedure and methods of third order theodolite and total station traversing.</p> <p>9.0 Understand the basic principles and methods of using total station and GIS Equipment.</p> <p>10.0 Understand problems involved in producing contoured plans.</p>
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PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Principles of Surveying		CODE: WRE 107		CONTACT HOURS: 1 – 0 - 4		
Goal: The student on completion of this course should have a sound understanding of basic principles of surveying and be able to undertake field surveying required for Water Resources Engineering Projects.						
Course Specification: THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	General Objective 1.0: Know the fundamental concepts of surveying.					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Define Surveying 1.2 Distinguish between the following major divisions of surveying: (i) geodetic surveying (ii) plane surveying 1.3 State the uses of plane surveying (e.g. maps and plans, geographical, geological engineering, military purpose etc.). 1.4 Explain the three stages of surveying process. (i) reconnaissance (ii) observation and measurement (iii) presentation 1.5 Illustrate the basic principles of surveying measurements (linear and angular) 1.6 State the branches of surveying in mineral exploration and exploitation.	1. Develop instructional manual for teaching this course. 2. Explain the fundamental concepts of surveying. 3. Explain the relevance of surveying to mining industry and the various professions where surveying is significant	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

General Objective 2.0: Appreciate surveying trigonometry.						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
2	1. Review trigonometric ratios of common angles. 2. Solve problems involving triangles (sine rule, cosine rule, area of triangle, Napier's tangent rule).	1. Revise trigonometric ratios and solve problems involving triangles 2. Evaluate the students	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 3.0: Know basic survey drawing techniques						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
3	3.1 Explain the use of scales and handling of other drawing instruments.	1. Explain the use of basic survey drawing techniques 2. Evaluate the students	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> Identify all the drawing instruments (compasses, dividers, protractors, set squares, pencil, etc.) Demonstrate the simple procedure for ink-drawing and lettering techniques 	<ul style="list-style-type: none"> Develop practical manual for laboratory/workshop exercises in this course. Prepare practical as indicated in the manual 	Practical Manual. Drawing set, drawing board, drawing paper
General Objective 4.0: Understand leveling						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
4-5	4.1 Define leveling 4.2 Explain the following terms related to leveling: datum; level surface, line of collimation, mean sea level,	1. Explain the terms related to leveling 2. Describe basic principles of leveling 3. Evaluate the students	Instructional Manual. Recommended textbooks, e-books, lecture	Measure horizontal and vertical angles using theodolite.	<ul style="list-style-type: none"> Develop practical manual for laboratory/workshop 	Practical Manual. Theodolite, ranging rods, ranging staff,

	bench mark. 4.3 Describe the basic principle of leveling 4.4 Explain the following leveling procedure: (a) compound leveling (b) flying level (c) profile leveling (d) reciprocal leveling. 4.5 Explain the reduction of leveling results by (a) rise and fall method, and (b) height of collimation method. 4.6 Describe the effect of each curvature and atmospheric refraction on leveling. 4.7 State typical errors that may occur in leveling.		notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.		exercises in this course. <ul style="list-style-type: none"> • Prepare practical as indicated in the manual. • Identify working components of theodolite and measure horizontal and vertical angles with theodolite. 	survey record book
General Objective 5.0: Know traversing						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
7	5.1 Define Traversing. 5.2 Describe the principle of traversing 5.3 Explain the methods of adjustment of closed traverses, - Bowditch method and transit method. 5.4 Perform calculations of bearings, distances and Co-ordinates from traverse surveys	1. Explain the concept of traversing 2. Solve problems of bearings, distances and coordinates from traverse surveys.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	■	■	■

General Objective 6.0: Know triangulation						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
8	6.1 Define triangulation 6.2 Describe the principle of triangulation 6.3 State application of triangulation 6.4 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. 6.5 Explain methods of measurement of triangulation angles (re-iteration and repetition methods) 6.6 Explain methods for adjusting values of triangulation angles (triangle, braised quadrilateral and polygonal adjustments). 6.7 Write angular observations in conventional forms.	1. Describe the triangulation principles and its methods of measurement 2. Asses the students	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 7.0: Know tacheometry						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
9	7.1 Define tachometry 7.2 Describe the principle of the stadia-system (fixed-hair and sub tense tacheometers)	1. Explain the concept tachometry, 2. Describe the determination of	Instructional Manual. Recommended textbooks, e-	<ul style="list-style-type: none"> • Conduct a tachometric exercise. • Determine tachometric constants 	<ul style="list-style-type: none"> • Develop practical manual for laboratory/ 	Practical Manual. Theodolite tacheometers

	7.3 Describe the determination of tachometric constants. 7.4 Describe the sub tense system 7.5 Outline the optical wedge system. 7.6 Explain tachometric methods for plotting contours	tachometric constants and 3. Describe sub tense system 4. Asses the students	books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic board, flip charts, etc.	from field measurement. • Plot contours from tachometric measurements in 7.8 above.	workshop exercises in this course. • Prepare practical as indicated in the manual	Staff Ranging Poles
10	1.1 Observe small vertical angles precisely by repetition. 1.2 Determine horizontal distance using vertical stage and tacheometer. 1.3 Explain the special characteristics and use of self reducing tacheometers. 1.4 Measure distances using a theodolites as tacheometer. 1.5 Determine spot-heights and survey detail by tacheometry.	Illustrate with good examples activities in 1.1 to 1.5 and ask the students to solve problems on them. <input type="checkbox"/> Assess the student	Engineer's level Field book	1. Carry out compass traversing of a closed figure 2. Produce the plan and make graphical adjustment.	▪ Demonstrate compass traversing and direct the student to produce plan.	▪ Compass, drawing paper, scales, pencil, rules, eraser.
Week	General Objective 8.0: Understand the procedure and methods of third order theodolite and total station traversing.					
11	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	2.1 List specifications for measurement of angles and distance. 2.2 Determine bearings and tolerable linear and angular misclosures for secondary and tertiary traverses. 2.3 Explain the need for connection to and procedure for verification of existing controls. 2.4 Describe field method of traversing using surface	Lecture Worked examples to demonstrate computations.	Theodolite Tapes	• Identify the various items of equipment used in theodolite and total station traversing. • Carry out theodolite traversing of the roads surrounding the school 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

	<p>taping.</p> <p>2.5 Explain the various precautions in field measurements.</p> <p>2.6 Describe the field checks applicable.</p> <p>2.7 Use the force centering equipment explaining special advantage thereof.</p> <p>2.8 Explain the role of theodolite and total station traversing in provision of control for surveys.</p> <p>2.9 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 plan in ink</p>					
Week	General Objective: 9.0 Understand the basic principles and methods of using total station and GIS Equipment.					
12	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>4.1 Describe a total station and its accessories.</p> <p>4.2 Compare total station with a theodolite.</p> <p>4.3 Explain the working principles of a total station.</p> <p>4.4 Describe the procedures of observation with a total station.</p> <p>4.5 Carry out a simple survey using a</p>	<p>Illustrate with good examples activities in 4.1 to 4.11.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Total station Targets Computer GPS Software</p>	<p>Use theodolite along with staff to obtain distances and heights. Use total station to obtain values</p>	<p>Supervise the use of theodolites as in tacheometric surveys.</p>	<p>Paper, pencil, eraser. Theodolite, staff.</p>

	<p>total station.</p> <p>4.6 Retrieve the measured data from a total station field data on to a PC.</p> <p>4.7 Process the data from the PC.</p> <p>4.8 Plot the plan of the surveyed area manually.</p> <p>4.9 Describe the various types of GPS equipment e.g. hand held and tripod types.</p> <p>4.10 Explain the working principles of GPS.</p> <p>4.11 Carry out GPS observations on selected points.</p>					
Week	General Objective: 10.0 Understand problems involved in producing contoured plans.					
13	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>5.1 Name the different reference directions for contoured plan.</p> <p>5.2 Explain basic need for heights in topographical Engineering and Township Surveys.</p> <p>5.3 Illustrate optimum distribution of spot heights for contoured plans.</p> <p>5.4 Describe the use of grids of levels.</p> <p>5.5 Carry out contouring at 0.5m vertical interval from a mesh of spot heights.</p>	<p>Illustrate with good examples activities in 5.1 to 5.5.</p> <p><input type="checkbox"/> Assess the student</p>	<ul style="list-style-type: none"> ▪ Levels ▪ Theodolite 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪
<p>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.</p> <p>Revision : 2 weeks. Revise main topics, give worked examples etc.</p> <p>References : Surveying for Engineers (1994) Uren J Macmillan and Price WF, Setting Out Procedures (1998) Sonlorove BM Butherworth Heineman.</p> <p>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.</p>						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: MEC 112		Contact Hours: 1-0-3
	Subject/Course: Technical Drawing			Theoretical: 1 hours/week
	Year: 1 Semester: 1	Pre-requisite: -		Practical: 3 hours /week

General Objectives

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

	Course: Technical Drawing	Course Code: MEC 112				Contact Hours: 1-0-3	
					Theoretical: 1 hours/week		
	Year: One Semester: One	Pre-requisite: -				Practical: 3 hours /week	
	Theoretical Content				Practical Content		
	General Objective 1: Know different drawing instruments, equipment and materials used in technical drawing.						
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources	
1 – 2	<p>1.1 Identify the different types of drawing instruments, equipments and materials.</p> <p>1.2 State the uses of the various instruments, equipments and materials.</p> <p>1.3 State the precautions necessary</p> <p>1.4 Use each of the items in 1.1 above.</p> <p>1.5 Maintain the various instruments and equipments.</p>	<ul style="list-style-type: none"> Show the students all drawing instruments: Drawing set; T-Square; Drawing board; Set squares; Types of pencils (H to B). Explain the uses of drawing instruments. 	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>Use each of the items in 1.1. Maintain the various instruments and equipment</p>	<p>Carryout the use of the items in 1.1.</p> <p>Carryout the maintenance of the various instruments and equipments.</p>	<p>Black board ruler (1m)</p> <p>Black board Tee-Square</p> <p>Black board compass</p> <p>Blackboard protector</p> <p>Adjustable set-square</p> <p>60 set square</p> <p>45 set square</p> <p>French curve set</p> <p>Templates</p> <p>Complete drawing table.</p>	

General Objective 2: Know Graphical Communication						
	<p>2.1 Explain graphics and different types of graphic presentation.</p> <p>2.2 Illustrate the various convention present in graphical productions of construction lines, finished lines, hidden and overhead details projections, centre lines, break lines, dimensioning of plane, elevation and sections of objects.</p> <p>2.3 State the various standards of drawing sheets.</p> <p>2.4 Print letters and figures of various forms and characters.</p> <p>2.5 Illustrate conventional signs, symbols and appropriate lettering characters.</p>	<ul style="list-style-type: none"> ▪ Explain technical lettering in capital and small letters, using, free hand and using letter stencils. ▪ Identify the various standard sheets A0 –A4 	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic board, flip charts, etc.</p>	<p>Layout of drawing sheets with the following</p> <p>(a) Margins</p> <p>(b) Title block etc</p> <p>Illustrate in drawing the various types of lines based on BS 308 1972 Part 2.</p> <p>Set drawing area on A1 paper with a title block and the boarder lines.</p> <p>Draw conventional signs and symbols</p>	<p>Carryout layout of drawing sheets</p> <p>Carryout drawing of various types of lines based on BS 308 1972</p> <p>Demonstrate drawing area on A1 paper with a title block and the boarder lines.</p> <p>Carryout drawing of conventional signs and symbols.</p>	<p>Black board ruler (1m)</p> <p>Black board Tee-Square</p> <p>Black board compass</p> <p>Blackboard protector</p> <p>Adjustable set-square</p> <p>60 set square</p> <p>45 set square</p> <p>French curve set</p> <p>Templates</p> <p>Complete drawing table</p>
General Objective 3: Know the construction of simple geometrical figures and shapes.						
3 – 6	3.1 Explain the purpose of geometrical construction in drawing.	<ul style="list-style-type: none"> ▪ Discuss the various types of information 	<p>Instructional Manual.</p> <p>Recommended</p>	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪

		<p>required for writing technical report.</p> <ul style="list-style-type: none"> ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 	<p>textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>			
General Objective 4: Know Isometric and Oblique Projections.						
7 - 10	<p>4.1 Mention main sources of data.</p> <p>4.2 Discuss techniques of data collection:</p> <ul style="list-style-type: none"> • Laboratory. • Field survey/measurement. • Questionnaire. • Oral interviews. 	<ul style="list-style-type: none"> ▪ Guide student on techniques involved in sourcing data ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic board, flip charts, etc.</p>	▪	▪	▪
General Objective 5: Know single orthographic projections.						
11 - 12	<p>5.1 Explain how to present data in a manner suitable for writing technical report in the following form: Tables, Graphs, Charts, bars.</p> <p>5.2 Input information into computer.</p> <p>5.3 Print out results.</p>	<ul style="list-style-type: none"> ▪ Guide student on techniques involved in presenting information/ data ▪ Use questions and answer technique ▪ Give examples 	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic</p>	▪	▪	▪

		<ul style="list-style-type: none"> ▪ Give assignments 	Board, flip charts, etc.			
General Objective 6: Understand the intersections of regular solids.						
13 - 15	<p>6.1 Explain interpretation or intersections of solids.</p> <p>6.2 Draw the lines of intersections of the following regular solids and planes in both first and third angles.</p> <p>a. Two square-prisms meeting at right angles.</p> <p>b. Two dissimilar square prisms meeting at an angle.</p> <p>c. Two dissimilar square prisms meeting to an angle</p> <p>d. A hexagonal prism meeting a square prism at right angles.</p> <p>e. Two dissimilar cylinders meeting at an angle.</p> <p>f. Two dissimilar cylinders meeting at right angle, their centres not being in the same vertical plane.</p>	<p>Ask students to give examples of intersection of solids</p> <p>Ask students to construct:</p> <p>a. Two square-prisms meeting at right angles</p> <p>b. Two dissimilar square prisms merely at “</p> <p>c. Two dissimilar square prisms meeting 60</p> <p>d. An hexagonal prism meeting a square prism</p> <p>e. Two dissimilar cylinders meeting at an anglef. Two dismal cylinders meeting at right angle, then centres at long in the same vertical place.</p> <p>g. As in 6.2</p>	<p>Recommended textbooks.</p> <p>Whiteboard, dust, Marker, lecture notes, drawing sets</p>	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪
<p>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.</p> <p>Competency: Students to acquire skills in technical report writing.</p>						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 101	Contact Hours: 2 – 0 - 1
Subject/Course: Engineering Mechanics		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 1 hours/week

General Objectives

- 1. Understand static equilibrium**
- 2. Understand the kinetics of rigid body**
- 3. Understand the vectorial behaviour of force system**
- 4. Know analytical and graphical methods of determining member forces**
- 5. Understand Simple Harmonic Motion**

	Course: Engineering Mechanics	Course Code: WRE 101		Contact Hours: 2 – 0 - 1		
				Theoretical: 2 hours /week		
	Year: ND I Semester: 1st	Pre-requisite:		Practical: 1 hours /week		
	Theoretical Content 2		Practical Content 1hour			
	General Objective 1.0: Understand static equilibrium					
Wee k/s	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1	1.1 Define and draw free body diagrams 1.2 Explain system of forces and types of	<ul style="list-style-type: none"> • Define, draw, explain, compute, use simple 	Instructional Manual. Recommend	Identify the magnitude, direction and	Perform Parallelogram of forces	Parallelogram of forces apparatus

	loads (concentrated and UDL)	models	ed textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	line of action of forces	experiment	
2 - 3	1.3 Compute, reactions, moments, friction forces and equilibrants. 1.4 Compute graphically	Illustrate with good examples activities in 1.3 to 1.4. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 2: Understand the Kinetics of rigid bodies						
4 - 5	2.1 State Newton's law of motion 2.2 Apply Newton's law of motion to compute impulse, momentum, potential and kinetic energy.	<ul style="list-style-type: none"> • State, apply, compose, resolve. • Calculate • Analyse 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen,		Demonstrate laws of Motion	

			Magnetic Board, flip charts, etc.			
6	2.3 Compose, resolve and determine resultants of velocity, relative velocity, and acceleration.	<ul style="list-style-type: none"> • Represent in vectorial form • Present in graphical form 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 3.0: Understand the Vectorial Behaviour of Force System						

7 - 8	3.1 Define Vector, 3.2 Express vector in direction and magnitude 3.3 Types of Vector 3.4 Addition of Vector 3.5 Multiplication of vector 3.6 Vector matrix	<ul style="list-style-type: none"> • Explain, solve examples • Explain vector matrix from the beginning 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 4.0: Understand analytical and graphical methods of determining member forces						
9 - 10	4.1 Determine member forces by methods of joints, sections and tension coefficients. 4.2 Repeat 4.1 using graphical methods. 4.3 Apply to analyse simple planer structures	<ul style="list-style-type: none"> • Determine, apply, using simple models 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

		•	e-books	▪	▪	▪
General Objective 5.0: Understand Simple Harmonic Motion						
– 11-13	6.1 Define harmonic Motion 6.2 Define periodic motion 6.3 Derive Spring constant 6.4 Derive Pendulum equation 6.5 Apply on typical engineering systems	<ul style="list-style-type: none"> Define, explain, calculate using typical engineering system 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Identify periodic and harmonic motions	<ul style="list-style-type: none"> Perform spring experiment Perform Pendulum experiment 	<ul style="list-style-type: none"> Pendulum apparatus Spring Motion apparatus
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 113	Contact Hours: 0 – 0 - 4
Subject/Course: Workshop Technology		Theory: 0 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 4 hours/week

General Objectives

1. **To introduce the students to setting out, brickwork/blockwork and concreting**
2. **To introduce the students to elementary plumbing operations**
3. **To introduce the students to elementary woodwork**
4. **To introduce the students to elementary metalwork**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Workshop Technology I		Course Code: WRE 113		Contact Hours: 0 – 0 - 4		
Course Specification:	Theoretical Content: 0 hrs		Practical Content: 4 hrs			
Course Objective: : To introduce the students to setting out, concrete work, brickwork/blockwork, carpentry/woodwork and metal work						
Week	General Objective 1: To introduce the students to setting out, brickwork/blockwork and concreting					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1-4	▪	▪	▪	<ul style="list-style-type: none"> ▪ Sketch a site layout to know how to set out a simple structure foundation and super structure. ▪ Set out a simple water structure 	<ul style="list-style-type: none"> ▪ Guide students to prepare site plan ▪ Provide materials schedule and supervise the execution in groups. 	<ul style="list-style-type: none"> ▪ Magnetic board ▪ Pegs, nails, line, angles, tapes, wooden rails, optical square, compass and other survey equipment
	▪	▪	▪	<ul style="list-style-type: none"> ▪ Execute foundation trench and cast concrete. ▪ Execute block laying of various sizes and bound with cement sand mortar ▪ Laying of blocks/brick in different bonds 	<ul style="list-style-type: none"> ▪ Demonstrate execution of the procedure. ▪ Supervise foundation construction. ▪ Demonstrate laying and bound for 9 inches hollow blocks filled with plain concrete ▪ Demonstrate the four bonds e.g. English, Stretcher, Flemish, Cross etc. 	<ul style="list-style-type: none"> ▪ Spades, diggers, Shovels, Wheelbarrows, Plumbs level, dump level, staff, rods, measuring tapes, concrete mixer, batching boxes. ▪ Sandcrete blocks, Cement, sand, crush aggregates, water, trowel, float, square, spirit level. ▪ Blocks mortar, bricks, trowels, floats.

General Objective 2: To introduce the students to elementary plumbing operations						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5-8	▪	▪	▪	Provide separate pipes for waste water drainage	▪ Demonstrate the plumbing for waste water.	▪ Pipes, blocks, yarning, Pipe range, threading , Machine, gums,
	▪	▪	▪	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.
	▪	▪	▪	<ul style="list-style-type: none"> • 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 • Carry out the installation of sanitary appliances. Use the principles of sewage disposal to propose a simple sewage treatment for your institution. 	<ul style="list-style-type: none"> ▪ Demonstrate practically a simple but typical plumbing installation. ▪ Guide and supervise installation including identifying the various materials and tools ▪ Supervise the operation 	<ul style="list-style-type: none"> ▪ Plastic copper and GI pipes including their elbows, beads, joints and valves yarn and putty, pipe wrench, pipe standing mobile vice mounted on a tripod, measuring tape and adhesives. ▪ WC. WHB, Bath, putting, pipes, valves, pipe wrench, pipe wrench, hack saw and standing vice.

General Objective 3: To introduce the students to elementary woodwork						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
9-12	▪	▪	▪	Identify construction wood types, sizes and nails (sizes), Screws.	▪ Make the students to identify available sizes in the market.	▪ Provide various sizes.
	▪	▪	▪	Prepare a piece of wood by hand and machine	▪ Demonstrate cutting, Planning, Chiselling.	▪ Workbench, Saw, Plane, Chisel, level, Tri-square with spirit level.
	▪	▪	▪	Prepare the layout of a standard Carpentry and joinery workshop.	▪ Guide students to prepare workshop layout.	▪ Cardboard, Drawing Sheets Drawing Materials
	▪	▪	▪	Prepare joints such as halving, Mortise, Tenon, Widening, Lapped, Fished and Car-Case Joints	▪ Show already prepared samples of various joints. Artisan to demonstrate and guide students in production under Teachers' supervision.	▪ Wood, Vice, Work bench, Mallet, Chisels, Tool box, Saw, Gauge, Screw Gauge, Markers, Pencils, Marker, Steel/Wooden nail.
	▪	▪	▪	Make use of metal dogs/fastening and gusset plates	▪ Show student the metal dogs, fastenings and gusset plates.	▪ Metal dogs, fastening and gusset plates.
	▪	▪	▪	Construct a. a single wooden floor b. a double wooden floor c. floor board joints	▪ 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.
General Objective 4: To introduce the students to elementary metalwork						

13-15	▪	▪	▪	Perform cutting, filling and threading and dicing operations 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
<p>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.</p> <p>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.</p>						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 103	Contact Hours: 2 – 0 - 2
Subject/Course: Water Resources Engineering Construction		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 2 hours/week

General Objectives

- 1. Understand the activities involved in the construction of water structures**
- 2. Know the various water structures and their functional requirements.**
- 3. Understand the general principles of selecting and preparing sites to receive various types of foundation**
- 4. Understand the principle of damp-proofing in water retaining structures**
- 5. Know the types and uses of scaffolding**
- 6. Understand the needs for external works around Water structures**
- 7. Understand the general administration of construction process. (Head office and sites)**
- 8. Know the various construction equipment required for the Construction of water structures**

PROGRAMME: National Diploma in Water Resources Engineering Technology						
Course: Water Resources Engineering Construction		Course Code: WRE 103		Contact Hours: 2 – 0 - 2		
Course Specification:		Theoretical Content: 2hrs		Practical Content: 2 hours		
Week	General Objective 1.0: Understand the activities involved in the construction of water structures					
1-3	Specific Learning Outcome: 1.1 List the site activities which precede the actual construction water structures such as temporary works, access roads, materials storage, accommodation, site huts, offices and site conveniences 1.2 Name and explain factors to be considered in site organization and layout. 1.3 Describe the process of setting out water structure using the following 3.4, 5, method; builders square method, theodolite, dumpy level, total station etc. 1.4 Explain the importance of Engineering	Teacher Activities <ul style="list-style-type: none"> • Lecture, • demonstrate, • explain field exercise 	Resources <ul style="list-style-type: none"> • Teaching tools, • Chain/tape, • Theodolite • ranging poles • pegs • line. • Site map(s) • Static pictures • Video clips 	Specific Learning Outcome: <ul style="list-style-type: none"> • Learn site experience • Demonstrate route survey and alignment of pipeline project • Demonstrate setting out processes for a water structure. 	Teacher Activities <ul style="list-style-type: none"> • Arrange site visit • Carry out route survey and alignment of pipeline project • Carry out setting out processes for a water structure. 	Resources Builders square, theodolite, dumpy level, total station.

	<p>Surveying in route location of Pipelines.</p> <p>1.5 Illustrate how alignments, right of way, Profile leveling and cross sections are carried out.</p> <p>1.6 Explain how bush clearing, felling of trees, removal of stumps are carried out.</p> <p>1.7 Explain how pipeline excavation are carried out</p> <p>1.8 Explain pipeline bedding, pipe laying, backfilling and compaction</p> <p>1.9 Explain spoil and hauling of materials.</p> <p>1.10 State the processes for the blasting of rocks</p>					
Week	1. General Objective 2.0: Know the various water structures and their functional requirements.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4-5	2.1 Enumerate the components of water structure,	<ul style="list-style-type: none"> • Lecture • Draw • Explain 	<ul style="list-style-type: none"> • O/H projector • Teaching tools • Videos 	▪	▪	▪

	<p>etc, foundation, floor, wall, basement, etc.</p> <p>2.2 Identify the different functional requirements of water structural components.</p> <p>2.3 Sketch these various water structural components</p> <p>2.4 Identify the different functional requirements of water structural components.</p>		<ul style="list-style-type: none"> • Static pictures 			
Week	General Objective 3.0: Understand the general principles of selecting and preparing sites to receive various types of foundation.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6-8	<p>3.1 Describe the process of site selection</p> <p>3.2 Describe the process of site take-over</p> <p>3.3 Describe the process of site clearing</p> <p>3.4 Describe the process of site set out</p>	<ul style="list-style-type: none"> • Lectures • Show excavation process(vide o) • pictures 	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	Demonstrate setting out	Provide sketches and carry out setting out	<ul style="list-style-type: none"> • Drawings • Measuring tapes • Pegs • Builders square • Theodolite

<p>3.5 Explain the methods of excavation.</p> <p>3.6 List the tools used in manual method of excavation.</p> <p>3.7 Describe the principal machines used in excavation.</p> <p>3.8 Explain with sketches the different methods of earthwork support to trenches in different types of soils.</p> <p>3.9 Define the term foundation.</p> <p>3.10 Explain the importance of foundation to water structures.</p> <p>3.11 State the various types of soils and how they affect the choice of foundation.</p> <p>3.12 Describe the different types of foundations and their application.</p> <p>3.13 Illustrate simple methods of reinforcement in foundations - ground beams,</p>					
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	<p>pad and raft foundation.</p> <p>3.14 Explain the methods of construction of the various types of foundations.</p> <p>3.15 Sketch section and plan of ground beam, pad and raft foundation.</p>					
Week	General Objective 4.0: Understand the principle of damp-proofing in water structures					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
9	<p>4.1 Explain damp-proofing</p> <p>4.2 Explain the processes of damp-proofing.</p> <p>4.3 Enumerate the various damp-proofing materials in use.</p> <p>4.4 Explain the importance of hardcore.</p> <p>4.5 Explain the use of blinding.</p> <p>4.6 Use anti-termite treatment in the foundation works</p>	<ul style="list-style-type: none"> • Lecture • Display of damp-proofing material • Pictures • Video clips 	<ul style="list-style-type: none"> • Anti-termite (childrex) • Samples of damp-proof materials • Samples of hardcore 	▪	▪	▪
Week	General Objective 5.0: Know the types and uses of scaffolding.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
10	5.1 Explain the principles of scaffolding.	<ul style="list-style-type: none"> • Lecture • Sketches' • Pictures 	<ul style="list-style-type: none"> ▪ Teaching tools. ▪ Pictures ▪ Video 	▪	▪	▪

	<p>5.2 State the use of scaffolding in walls and suspended floor construction.</p> <p>5.3 Explain the procedure for providing scaffolding for the various water retaining structure construction</p>	<ul style="list-style-type: none"> • Scaffold installation video 				
General Objective 6.0: Understand the needs for external works around the Water structures						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11-12	<p>6.1 Explain the essence of having external works around a water structures, lawns, grass, landscaping.</p> <p>6.2 State the functions of external works in water structures</p> <p>6.3 Explain the functions of fencing and hedges in water structures</p> <p>6.4 State the functions of sewage systems, e.g. septic tank, soak away pits, manholes, inspection, chambers, and sewers.</p> <p>6.5 Explain with illustration how</p>	<ul style="list-style-type: none"> ▪ Lecture, ▪ Sketch ▪ Pictures ▪ Video clips 	<ul style="list-style-type: none"> ▪ Drawings, 	Plan a given site	Give an example	Drawing materials

	<p>sewage systems in 6.4 above are constructed</p> <p>6.6 State the underlying principles in planning a good drainage system</p> <p>6.7 Apply the principles of landscaping to a given site layout inculcating all items of external works</p>					
General Objective 7.0: Understand the general administration of construction projects.						
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
13	<p>7.1 Explain the responsibilities of the various parties involved in the construction industry: Client, Consultant, Cost engineers, engineers etc.</p> <p>7.2 Define contract, different types of contracts and explain the procedures involved in signing and completion of Contracts</p> <p>7.3 Describe the different types of</p>	Lecture provide example from a contract	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	tendering procedure. 7.4 Outline the methods of site layout and organisation – pre-contract planning services on site, safety and security.					
week	General Objective 8.0: Know the various construction equipment required for the Construction of water structures.					
14-15	8.1 List the relevant equipment used in the construction of water structures and mention what they are used for such: <ol style="list-style-type: none"> a. Ripper - for uprooting b. Bulldozers - for clearing c. Power saws - tree cutting/falling d. Motor graders - leveling and cutting of side ditches, spreading and Cambering. e. Rollers - for compaction f. Pay loaders - for loading trucks g. Trucks - for haulage 	<ul style="list-style-type: none"> ▪ Lectures ▪ Provide examples ▪ Video clips ▪ Pictures 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Organise site visits	<ul style="list-style-type: none"> ▪ Show different equipment 	<ul style="list-style-type: none"> ▪ Provide logistics on transportation of students

	<ul style="list-style-type: none"> h. Scrapers - for grading and leveling i. Water tankers - watering j. Crushing plant - production of aggregates. k. Concrete mixing and transporting plant 					
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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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: MTH 112	Contact Hours: 2 – 0 - 0
Subject/Course: Algebra And Elementary Trigonometry		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 0 hours/week

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 its 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: 2 – 0 -0			
Course Specification:		Theoretical Content 2 hrs/week				
WEEK	General Objective 1.0: Understand laws of indices and their applications in simplifying algebra expressions					
	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
1	1.1 Define indices 1.2 Establish the laws of indices 1.3 Solve simple problems using the laws of indices.	Illustrate with good examples activities in 1.1 to 1.3 and solve problems. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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. $18D = 3\%4JPC^2 \wedge M^B$, find D when J = 0935, e.g. $\theta = 35$, P = 1.6 10^6 , C = 55, M = 0 0025. $\pi = 3.142$ 2.8 Apply logarithm in solving non-linear equations. e.g. $y = ax^n$; $\log y = \log a + n \log x$; $y = bc^x$, $\log y = \log b + x \log c$; $Y = a + bx^n$, 2.9 Define surds 2.10 Reduce a surd into its simplest form	Ask the students to solve logarithmic and surd related problems	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
	2.11 Solve simple problems on surds					
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	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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. 4.5 Form equations whose roots are given in different methods.	Ask the students to solve quadratic equations	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 5.0: Understand Permutations and Combinations						
	5.1 Define permutation 5.2 State examples of permutations	Give exercises on	Instructional Manual.	▪	▪	▪

	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
6	5.3 Define combination 5.4 State examples of combination 5.5 Establish the theorem ${}^n P_r = \frac{n!}{(n-r)!}$ giving examples e.g. number of ways of collecting two out of 8 balls	permutation and combination to them	Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
General Objective 6.0: Understand the concept of set theory						
7	6.1 Establish ${}^n C_r = {}^n C_{n-r}$ 6.2 Define sets, subsets, and null sets 6.3 Define union, inter-section and completion of sets 6.4 Draw Venn diagrams to demonstrate the concepts in 6.1 and 6.3 above. 6.5 Calculate the size or number of elements in a given set.	Give exercises on set theory	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.)	Ask the students to apply progression to solve problems	Instructional Manual. Recommended textbooks, e-books, lecture notes,	▪	▪	▪

	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
	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 20 terms. 7.7 Define Arithmetic Mean (AM) and Geometric Mean (G.M.) 7.8 Define convergence of series. 7.9 Define divergence of series.		Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
General Objectives 8.0: Understand the binomial theorem and its application in the expansion of expressions and in approximations.						
10	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 $(x + y)^2$, $(x^2 B \underline{1})^s$ 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.	State the importance and application of the theorem	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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	Apply the techniques of vectors to solve various problems	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint	▪	▪	▪

	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
	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.		Projector, Screen, Magnetic Board, flip charts, etc.			
	General Objectives 9.0: Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems					
12	9.14 Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. 9.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. 9.16 Apply vectoral techniques in solving problems involving relative velocity. 9.17 State the scalar product of two vectors. 9.18 Compute the scalar product of given vectors. 9.19 Define the cross product of the vector product or two vectors. 9.20 Calculate the direction ratios of given vectors. 9.21 Calculate the angle between two vectors using the scalar product.	Apply the techniques of vector to solve various problems	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
	General Objectives 10.0: Understand the Concept of equations and apply same to engineering problems					
	10.1 Explain the concept of equation, i.e. $A = B$ 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.	Ask the student to solve various equations as indicated in section 10	Instructional Manual. Recommended textbooks, e-books, lecture notes,	▪	▪	▪

	Specific Learning Outcomes	Teacher Activities	Resources	Specific Learning Outcomes	Teacher Activities	Resources
13 -	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.		Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
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; $\text{Cos}^2 \theta + \text{Sin}^2 \theta = 1$, $\text{Sec}^2 \theta = 1 + \tan^2 \theta$, etc. 11.4 Derive the compound angle formulae for $\sin (A+B)$, $\text{Cos} (A+B)$ and $\text{Tan} (A+B)$.	Define and Derive the trigonometric ratios and identities	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: CEC 107	Contact Hours: 1 – 0 - 2
Subject/Course: Introduction to Fluid Mechanics		Theory: 1 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 2 hours/week

<p>General Objectives:</p> <p>1.0 Understand the general properties of fluids</p> <p>2.0 Know fluids' static and pressure effects.</p> <p>3.0 Understand buoyancy of floating bodies.</p> <p>4.0 Understand the basic principle of fluid motion.</p> <p>5.0 Know about flow through orifices, weirs etc.</p> <p>6.0 Understand the different types of flow in pipes</p> <p>7.0 Understand the nature of uniform flow in open channel</p>
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PROGRAMME: ND Water Resources Engineering Technology						
Course: Introduction to Fluid Mechanics			Course Code: CEC 107		Contact Hours: 1 – 0 - 2	
Course Specification: Theoretical Content: 1hr				Practical Content: 2 hrs		
Course Objectives 1.0:						
Week	General Objective 1.0: Understand the general properties of fluids					
1	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	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 capillarity (with units and introduction of dimensions). 1.4 Explain diffusion of liquids and gases.	<ul style="list-style-type: none"> ▪ Lecture and state relationship between the quantities. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Determine the properties of fluids	Prepare the laboratory and required equipment	Weighing balance, measuring cylinder, manometers, barometers, etc
Week	General Objective 2.0: Know fluids' static and pressure effects.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
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.	<ul style="list-style-type: none"> ▪ Lecture and illustrate with simple calculations. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic	Measure the intensity of fluid pressure.	Prepare the laboratory and required equipment	Manometers Pressure gauges (barometers) Hydraulic Jack

			Board, flip charts, etc.			
Week	General Objective 3.0: Understand buoyancy of floating bodies.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3	3.1 Define buoyancy 3.2 State the conditions of equilibrium of floating body 3.3 Define metacentric height. 3.4 Determine the metacentric height	<ul style="list-style-type: none"> Lecture and illustrate each with relevant calculations. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Determine the metacentric height	Prepare the laboratory and required equipment	<ul style="list-style-type: none"> stability of floating bodies apparatus centre of pressure apparatus Metacentric height apparatus
Week	General Objective 4.0: Understand the basic principle of fluid motion.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4-5	4.1 Define basic types of flows. 4.2 State continuity equation, momentum equation and Bernoulli's Theorem.	<ul style="list-style-type: none"> Lecture, and illustrate with calculations. Solve problems relating to 4.2 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	4.3 Carry out experiment on 4.2	Prepare the laboratory and required equipment	Bernoulli's Apparatus, Impact of jet apparatus

Week	General Objective 5.0: Know about flow through orifices, weirs, etc.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6 -7	5.1 Explain the application of venturimeter and pitot tube. 5.2 Explain flow through notches and weirs. 5.3 Identify flow in small and large orifices 5.4 Establish relationship between flow rate and pressure difference.	<ul style="list-style-type: none"> Lecture, demonstrate with examples 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> Measure the flow of fluids through pipes Measure the flow of water using notches and weirs Determine the C_c, C_v and C_d of orifice meter of different sizes Determine partial pressure of fluids Determine the relationship between head and sill of weirs and discharge 	Prepare the laboratory and required equipment	Venturimeter, Pitot tube Open channel flow apparatus, Orifice meter, weirs, notches etc
General Objective 6.0: Understand the different types of flow in pipes						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
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	<ul style="list-style-type: none"> Lecture, and illustrate with worked examples 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> Demonstrate laminar and turbulent flows Investigate the relationship between Darcy's friction and Reynolds's number for laminar, turbulent flows and flow through smooth pipes. 	<ul style="list-style-type: none"> In all these practical sessions, the technologist should prepare samples and equipment under the supervision of the lecturer. Technologist should assist students with methodology, 	<ul style="list-style-type: none"> Flow visualization equipment. Laminar and turbulent flow pipes. Current meters Friction loss equipment Hydraulic bench Centrifugal (Pelton wheel)

9	<p>6.7 Explain head losses in pipe (i.e. roughness coefficients)</p> <p>6.8 Explain local losses in pipes, i.e. sudden expansion and contraction, bends, valves, gates, etc. in shear flow situation.</p>	Lecture, and illustrate with worked examples	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>		<p>monitor students during practical, grade the students work and submit grades to the lecturer.</p>	<p>apparatus</p> <ul style="list-style-type: none"> ▪ Pipe friction apparatus
10	6.9 Explain pressure and velocity in ideal fluids and in shear flow situation.	Lecture, and illustrate with worked examples	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	Investigate the relationship between Darcy's Friction coefficient and Reynolds number for laminar, turbulent flows and flow in smooth pipes.		
11-12	<p>6.10 Distinguish between pumps and turbines.</p> <p>6.11 Explain energy transformation by pumps and turbines.</p>	Lecture, and illustrate with worked examples	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector,</p>		Prepare the laboratory and required equipment	

			Screen, Magnetic Board, flip charts, etc.			
General Objective 7.0: Understand the nature of uniform flow in open channel						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
13	7.1 Explain open channel flow 7.2 Explain uniform flow in open channel	<ul style="list-style-type: none"> ▪ Lecture and illustrate with calculation 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Establish uniform flow conditions in rectangular channels and estimate the Manning's coefficient for the channel. .	Prepare the laboratory and required equipment	Hydraulics bench, flume etc
14	7.3 Describe most economical sections.	Lecture and illustrate with calculation	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			

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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: STA 111	Contact Hours: 2 – 0 - 0
Subject/Course: Introduction to Statistics		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 0 hours/week

General Objectives:

1. **Understand statistics and all that it stands for.**
2. **Understand the different methods of data collection and their limitations.**
3. **Know the different forms of data presentation**
4. **Understand the use and the importance of some measures of central tendency in summarizing data.**
5. **Understand the use and importance of measures of dispersion in summarizing data**
6. **Know the different types of random variables**
7. **Understand the basic principles of probability**
8. **Understand some basic probability distributions and how to identify each distribution**
9. **Understand the principles of correlation of two variables and the regression of one variable on another.**

PROGRAMME: National Diploma In Water Resources Engineering Technology						
COURSE: Introduction to Statistics			COURSE CODE: STA 111		CONTACT HOURS: 2 – 0 - 0	
Course Specification: Theoretical Contents						
WEEK	Special Learning Outcomes	Teachers Activities	Resources	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	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 2.0: Understand the different methods of data collection and their limitations.						
2-3	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	Illustrate with good examples activities in 2.1 to 2.5. □ Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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 from a given data 3.3 Explain the usefulness of diagrams in	Lecture Give sample charts Give students assignments	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard,	▪	▪	▪

	<p>presenting statistical data</p> <p>3.4 Construct bar chart, pie chart, histogram, frequency polygon and cumulative frequency polygon for a given set of data</p> <p>3.5 Outline the merits and demerits of each diagram in 3.4 above.</p>		PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
General Objective 4.0 Understand the use and the importance of some measures of central tendency in summarizing data.						
6-7	<p>4.1 Define Arithmetic mean, Geometric Mean, Median, Mode and harmonic Mode and harmonic mean</p> <p>4.2 Compute the measurer in 4.1 above given: i. ungrouped ii. grouped data</p> <p>4.3 Explain the uses of Geometric means</p> <p>4.4 Calculate: Quantiles Deciles Percentiles given a set of data List the merits and demerits of all the above measured of central tendency.</p>	<p>Illustrate with good examples activities in 4.1 to 4.4.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
General Objective 5.0: Understand the use and importance of measures of dispersion in summarizing data						
8	<p>5.1 State the importance of measures of dispersion</p> <p>5.2 Defined and calculate the: mean deviation, Semi interquartile range Variance and standard deviation</p> <p>5.3 Describe the application of the measures of dispersion defined in 5.2 above.</p> <p>5.4 Calculate these standard error of the sample mean for given data</p>	<p>Illustrate with good examples activities in 5.1 to 5.4.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
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 6.4 State examples of discrete and continuous variables	Illustrate with good examples activities in 6.1 to 6.4. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.	Illustrate with good examples activities in 7.1 to 7.5. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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	Illustrate with good examples activities in 8.1 to 8.16. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	<p>with replacement</p> <p>8.11 Solve given problems applying binomial distribution</p> <p>8.12 Describe normal distribution curve and the empirical distribution rule</p> <p>8.13 Explain the characteristics of Normal distribution. Calculate the probability given the deviation from the mean</p> <p>8.14 Calculate the deviation given the means, standard deviation and a particular observation</p> <p>8.15 Calculate the area under the curve at different point from either side of the mean.</p> <p>8.16 Apply Normal distribution curve to simple problems</p>					
General Objectives 9.0: Understand the principles of correlation of two variables and the regression of one variable on another.						
14 - 15	<p>9.1 Define correlation</p> <p>9.2 State the types of correlation</p> <p>9.3 Describe the methods of studying correlation</p> <p>i. Scatter diagram (graphic method)</p> <p>ii. Karl Pearson's coefficient of correlation</p> <p>iii. Spearman's rank correlation</p> <p>9.4 Calculate Pearson's and Spearman's correlation coefficients</p> <p>9.5 Define regression equation of the form $Y=a+bx$ using free-hand method and method of least squares.</p>	<p>Lecture</p> <p>Give sample Charts</p> <p>Give students assignments</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
<p>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.</p> <p>COMPETENCY: The Student should be able to apply basic statistical methods in the construction industry</p>						

Department/Programme: ND Water Resources Engineering Technology	Course Code: GNS 101	Contact Hours: 2 – 0 - 0
Subject/Course: Communication Skills I		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 0 hours/week

GENERAL OBJECTIVES:

On completion of the course the student should:

- 1.0 Develop appropriate study skills.**
- 2.0 Know the nature of language.**
- 3.0 Understand the basic rules of grammar.**
- 4.0 Know the essential qualities of paragraph.**
- 5.0 Appreciate literacy works in English.**

PROGRAMME:						
COURSE: USE OF ENGLISH			COURSE CODE: GNS 101		CONTACT HOURS: 2 – 0 - 0	
GOAL: This course is designed to provide the student with the necessary language skills which enable him to cope effectively with the challenges of his course, to use English Language effectively in the practice of his chosen profession as well as interact with others in the society.						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Develop appropriate study skills.						
Week	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	Study Skills 1.1 Explain the necessity for acquiring good note taking/making techniques. 1.2 List the methods of note-taking/making. 1.3 Use the dictionary correctly	<ul style="list-style-type: none"> Explain the necessity for acquiring good note taking/making techniques. List the methods of note-taking/making. Use the dictionary correctly 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
2	1.4 List information sources in the Library. 1.5 Locate information in the sources listed in 1.4 above. 1.6 Identity good reading habits.	<ul style="list-style-type: none"> List information sources in the Library. Locate information in the sources listed in 1.4 above. Identity good reading habits. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
3	1.7 Explain the different methods of reading, viz, scan, skim, normal and study. 1.8 Use the different methods of reading explained in 1.7 above.	<ul style="list-style-type: none"> Explain the different methods of reading, viz, scan, skim, normal and study. Use the different methods of reading explained in 1.7 above. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint	▪	▪	▪

			Projector, Screen, Magnetic Board, flip charts, etc.			
General Objectives: 2.0 Know the nature of language.						
Week	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	
4	Language 2.1 Explain the concept of language. 2.2 List the characteristics of language. 2.3 Explain the four language skills, viz, speaking, listening, writing, reading.	<ul style="list-style-type: none"> • Explain the concept of language. • List the characteristics of language. • Explain the four language skills, viz, speaking, listening, writing, reading. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
5	2.4 Explain the functions of language. 2.5 List the uses of English Language in Nigeria, e.g. as the language of research, government, commerce, etc.	<ul style="list-style-type: none"> • Explain the functions of language. • List the uses of English Language in Nigeria, e.g. as the language of research, government, commerce, etc. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objectives: 3.0 Understand the basic rules of grammar.						
Week	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
6	Grammatical Conventions 3.1 Explain grammar 3.2 Explain parts of speech.	<ul style="list-style-type: none"> • Explain grammar • Explain parts of speech. 	Instructional Manual. Recommended textbooks, e-books, lecture	▪	▪	▪

			notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
7	3.3 Analyze the use of parts of speech in sentences. 3.4 Correct common errors in the use of parts of speech in sentences. 3.5 Construct sentences with correct syntactic arrangement.	<ul style="list-style-type: none"> Analyze the use of parts of speech in sentences. Correct common errors in the use of parts of speech in sentences. Construct sentences with correct syntactic arrangement. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
8	3.6 List punctuation marks. 3.7 Enumerate the uses of punctuation marks. 3.8 Punctuate a given passage. 3.9 Explain idioms	<ul style="list-style-type: none"> List punctuation marks. Enumerate the uses of punctuation marks. Punctuate a given passage. Explain idioms 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
9	3.10 Explain figures of speech. 3.11 Explain affixation. 3.12 Construct sentences to illustrate idioms, figures of speech and affixes.	<ul style="list-style-type: none"> Explain figures of speech. Explain affixation. Construct sentences to illustrate idioms, figures of speech and affixes. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

General Objectives: 4.0 Know the essential qualities of paragraphs.						
WEE K	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
10	Paragraphing 4.1 Define a paragraph 4.2 Name the parts of paragraph, viz., topic sentence, development, and conclusion/transition.	<ul style="list-style-type: none"> Define a paragraph Name the parts of paragraph, viz., topic sentence, development, and conclusion/transition. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
11	4.3 Explain the thematic qualities of a paragraph viz, unity, coherence and emphasis. 4.4 Explain methods of paragraph development, viz, example, definition, comparison and contrasts etc.	<ul style="list-style-type: none"> Explain the thematic qualities of a paragraph viz, unity, coherence and emphasis. Explain methods of paragraph development, viz, example, definition, comparison and contrasts etc. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
12	4.5 Explain methods of ordering details in a paragraph viz, less complex to more complex and vice versa, less important to more important and vice versa, spatial, chronological, etc. 4.6 Write specific paragraphs to illustrate 4.2 to 4.5 above.	<ul style="list-style-type: none"> Explain methods of ordering details in a paragraph viz, less complex to more complex and vice versa, less important to more important and vice versa, spatial, chronological, etc. Write specific paragraphs to illustrate 4.2 to 4.5 above. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

General Objective: 5.0 Appreciate literacy works in English.						
WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
13	Literature in English 5.1 Give the meaning of Literature. 5.2 Trace the development of literature.	<ul style="list-style-type: none"> Give the meaning of Literature. Trace the development of literature. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
14	5.3 Differentiate between the literary genres. 5.4 Explain the functions of literature.	<ul style="list-style-type: none"> Differentiate between the literary genres. Explain the functions of literature. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
15	5.5 Explain the terminology of prose fiction, e.g. plot setting, characterization etc. 5.6 Answer an essay question on a given novel.	<ul style="list-style-type: none"> Explain the terminology of prose fiction, e.g. plot setting, characterization etc. Answer an essay question on a given novel. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: GNS 111	Contact Hours: 2 – 0 - 0
Subject/Course: Citizenship Education I		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 0 hours/week

<p>General Objectives:</p> <ol style="list-style-type: none"> 1. Understand the Constitution of Nigeria
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- 2. Understand the federal system of government in Nigeria**
- 3. Know the constitutional rights and obligations of Nigerian citizens**
- 4. Understand Citizenships**
- 5. Understand fundamental objectives and directive principles of state policy in Nigeria**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Citizenship Education I			Course Code: GNS 111		Contact Hours 2HRS/WEEK	
Course Specification: Theoretical Content: 2 hrs					Practical Content: hrs	
General Objective: Understand Constitution						
Week	General Objective 1.0: Understand the Constitution of Nigeria					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher 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 they understand by the term constitution and to distinguish the different rules of constitution known to explain the effectiveness of International 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	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
Week	General Objective: 2.0 Understand the federal system of government in Nigeria					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5-7	2.1 Describe a federation 2.2 Distinguish a federation from a confederation	Ask the students: to describe a federation and to differentiate between a	Instructional Manual. Recommended	▪	▪	▪

	<p>2.3 Outline the basis for the federal system in Nigeria</p> <p>2.4 Examine the evolution, structure and functions of the federal system in Nigeria.</p> <p>2.5 Analyse the relationships among the three tiers of government in Nigeria</p> <p>2.6 Evaluate the revenue allocation formula in operation in Nigeria</p> <p>2.7 Compare and contrast other federation with Nigeria</p>	<p>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</p>	<p>textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>			
Week	General Objective: 3.0 Know the constitutional rights and obligations of Nigerian citizens					
8-9	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>3.1 Examine the significance of rights and obligations in Nigeria</p> <p>3.2 Assess government's protection of fundamental rights as contained in the Nigerian constitution</p> <p>3.3 Evaluate the responsibilities and duties of Nigerian citizenships and the benefits for performing them</p> <p>3.4 Assess the responsibilities and duties of constituted authority to the people</p> <p>3.5 Evaluate the responsibilities and duties of government to the People</p>	<p>Ask the students to identify the responsibilities and duties of Nigerian citizenship</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
Week	General Objective 4.0: Understand Citizenship					
10-12	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>4.1 Discuss the significance of citizenship</p> <p>4.2 Analyse the principles and benefits of citizenship</p> <p>4.3 Explain the difference in the modes</p>	<p>Ask the students: to discuss and analyse the principles and benefits of citizenship to analyse the basis for the</p>	<p>Instructional Manual. Recommended textbooks, e-</p>	▪	▪	▪

	<p>of acquiring citizenship</p> <p>4.4 Evaluate the merits and demerits of each type of citizenship</p> <p>4.4 Analyse the basis for the acquisition and withdrawal of Nigerian citizenship</p> <p>4.5 Examine the benefits derivable from Nigeria citizenship</p>	<p>acquisition and withdrawal of Nigerian citizenship</p>	<p>books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>			
Week	General Objective 5.0: Fundamental objectives and directive principles of state policy in Nigeria					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
13-15	<p>5.1 State the fundamental obligations of government as provided in the constitution</p> <p>5.2 Explain the general provisions of the fundamental objectives and directive principles of state policy</p> <p>5.3 Explain the political, economic, social and education policies of Nigeria</p> <p>5.4 Explain the directive principles and policy of the Nigerian government on culture, the mass media, national ethics and duties of the citizen</p> <p>5.5 Assess the conformity observance and application of the fundamental objectives and directive principles of state policy by governments and people of Nigeria.</p> <p>5.6 Recommend improvements on the provision conformity, observance and application of the fundamental objectives and directive principles of state policy</p>	<p>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</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>▪</p>	<p>▪</p>	<p>▪</p>
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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 105	Contact Hours: 2 – 0 - 0
Subject/Course: Introduction to Water Resources Engineering		Theory: 2 hours/week
Year: ND I Semester: 1st	Pre-requisite:	Practical: 0 hours/week

General Objectives

- 1.0 Know the history and concept of water resources**
- 2.0 Know the technical terms used in surface and groundwater**
- 3.0 Know water resources engineering equipments and their uses**
- 4.0 Understand water demand**
- 5.0 Understand water treatment processes**
- 6.0 Understand storage and distribution of water**
- 7.0 Understand rural water supply technology options**
- 8.0 Know standards and laws related to water resources engineering in Nigeria**

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Introduction to Water Resources Engineering		Course Code: WRE 105		Contact Hours: 2 – 0 - 0		
Course Specification:		Theoretical Content: 2 Hrs		Practical Content: 0 Hrs		
	Theoretical Content			Practical Content		
GOAL: The course is designed to enable student acquire basic knowledge of water resources engineering						
Week	General Objective 1.0: To Know the history and Concept of water resources					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1-2	1.1 Highlight the history of water resources development in Nigeria 1.2 Identify the major sources of water. 1.3 Outline the scope of water resources engineering 1.4 Highlight government policies with respect to water resources development in Nigeria. 1.5 Identify the factors affecting water resources development in Nigeria 1.6 Explain the concept of hydrological cycle	1. Trace the history of water resources development in Nigeria from the colonial period 2. Emphasize the major water sources in Nigeria 3. List the various works of a water resources engineer 4. Mention various strategies employed by government to boost water resources development 5. Sketch a diagram to show the relationship between different components of hydrological cycle	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
Week	General Objective 2.0: Know the technical terms used in surface and groundwater					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3	2.1 Define the following terms related to surface water: runoff, floodplain, stream discharge, gauge height, hydrological basins,, water budget etc 2.2 Define the following terms related	1. Explain terminologies related to surface water 2. Explain terminologies related to ground water 3. Sketch hydro geological cross	Instructional Manual. Recommended textbooks, e-books, lecture notes,	▪	▪	▪

	to groundwater: aquifers, aquiclude, aquitard, borehole, annular space, recharge, draw down etc.	section and label it to show some terms related to groundwater	Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
Week	General Objective 3.0: Know water resources engineering equipments and their uses					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4-5	1.1 Identify hydrological equipments 1.2 Identify hydro geological equipments 1.3 Identify irrigation equipments 1.4 Identify flow measuring equipments 1.5 Identify water lifting devices	1.Explain the use of hydrological equipments like current meter, rain gauge, anemometer etc 2.Explain the use of hydrogeological equipments like drilling rig, terrameters, dip meters, borehole loggers, borehole camera etc 3.Explain the use of equipment used for irrigation like sprinklers, pumps etc 4.Explain the operating principles of different types of pumps	Projectors, computers, pictures, Current meter, terrameters, loggers, dip meter, borehole camera , hand pump, submersible pump, surface pump	▪	▪	▪
Week	General Objective 4.0: Understand water Demand					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning	Teacher Activities	Resources
6-7	1.1State the various uses of water 1.2 Outline the factors affecting water consumption 1.3 Describe various method of population prediction	1. Mention various factors affecting water consumption. 2.Solve problems of population prediction using Arithmetic and Geometric method	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen,	▪	▪	▪

			Magnetic Board, flip charts, etc.			
Week	General Objective 5.0: Understand water treatment processes					
8-10	<p>1.1 List the impurities and their sources in water</p> <p>1.2 Outline the stages in water treatment</p> <p>1.3 List the maintenance and operational requirements of a water treatment plant.</p>	<p>1.Explain the physical, chemical and biological characteristics of water</p> <p>2. Explain different stages of water treatment</p> <p>3. Identify various parts of a treatment plant and how they can be maintained</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
	General Objective 6.0: Understand Storage and distribution of water					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning	Teacher Activities	Resources
11	<p>6.1 List the various ways of storing water</p> <p>6.2 Highlight the requirement of a good distribution system</p> <p>6.3 Give different layout for distribution system</p> <p>6.4 State the methods of maintenance of a water distribution system</p>	<p>1. Explain methods of storing water</p> <p>2. Explain the process of network design</p> <p>3. Solve problems to illustrate the above</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪

General Objective 7.0: Understand rural water supply technology options						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning	Teacher Activities	Resources
12-13	7.1 Identify the different sources of rural water supply 7.2. Enumerate factors affecting the choice of a particular technological options 7.3 Highlight the construction process of different options	1. Ask the students to give a list of various sources of rural water supply like hand dug well, borehole fitted with hand pump, spring , rain water harvesting 2. Explain the need for community participation in the selection of an option 3. Describe the construction process of different option	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
General Objective 8: Know standards and laws related to water resources engineering in Nigeria						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning	Teacher Activities	Resources
	8.1. Explain the need for standards and laws in water resources 8.2 Outline existing Nigerian standards and codes in water resources like Nigerian Drinking Water Quality Standard, Code of Practice in Water Well Construction, etc 8.2 Explain the motives of Nigerian water law	1. Explain the use of the standards and codes 2. Explain how they are being enforced 3. Highlight key areas of water law	Nigerian Drinking water quality standard. Code of Practice in water well construction, Water laws, projector, screen, computer	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: MEC 102	Contact Hours: 1 – 0 - 2
Subject/Course: Descriptive Geometry		Theory: 1 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 2 hours/week

<p>GENERAL OBJECTIVES:</p> <p>On completion of this module, the trainee should be able to:</p> <p>1.0 Know the construction of geometrical figures and shapes</p> <p>2.0 Understand orthographic projections</p> <p>3.0 Understand the developments and intersection of regular solids and planes</p>
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PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Descriptive Geometry		Course Code: MEC 102		Contact Hours: 1 – 0 - 2		
Course Specification: Theoretical Content: 1 hr				Practical Content :2 hr		
GOAL: This course is designed to develop the student’s skill in descriptive geometry and application of graphical Techniques						
Theoretical Content				Practical Content		
General Objective 1.0: Know the construction of different geometrical figures and shapes.						
Week /s	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1-5	1.1 Carry out simple geometrical constructions on ellipses, e.g. (a) Tangents to an ellipse at any given point on the ellipse, (b) Tangents to an ellipse from a given point outside the ellipse, etc. 1.2 Divide areas of plane figures. 1.3 Enlarge and reduce from the given areas of plane figures. 1.4 Define parabola and hyperbola 1.5 Construct Parabola and hyperbola using (a) Rectangular method (b) Ordinate method (c) Tangent method (d) Offset method. 1.6 Locate the directrix and focus of a given parabolic curve. 1.7 Construct a curve of a parabolic form through two given points. 1.8 Define locus of a point. 1.9 Define involute to a square, circle, cycloid and Archimedean spiral. 1.10 Construct involute to a square, circle, cycloid and Archimedean spiral.	Describe how to construct different geometrical figures and shapes	Lecture notes, Drawings, Pictures, Power point, Projector.	Perform simple geometrical constructions on ellipses Enlarge and reduce from the given areas of plane figures. Construct parabola and hyperbola Construct involute to a square, circle, cycloid and Archimedean spiral. Plot the locus of points	Carryout construction of different geometrical figures and shapes	Drawing boards. Drawing instrument

	<p>1.11 Describe the various types of link-mechanism.</p> <p>1.12 Plot the locus of points, e.g.</p> <p>(a) Mechanism with a link constrained to pass through a fixed point</p> <p>(b) Mechanism with the end of the link constrained to move in a horizontal line</p> <p>(c) Three links mechanism</p> <p>(d) Linkages of a mechanically operated level system</p> <p>(e) Mechanism of a printing press</p> <p>(f) Mechanism of a pair of secateurs.</p>					
General Objective 2.0; Understand Orthographic projections						
6-10	<p>2.1 Identify the third plane (the auxiliary or side vertical plane) of projection</p> <p>2.2 Project on it the end view of a three-Dimensional object.</p> <p>2.3 Sketch from an object with chamfer, round hole, stepped block, etc.) the plan and elevations and draw the sketched view in First and third angle orthographic Projection.</p> <p>2.4 Draw plan, elevations and sections of a Simple object such as hollow Sandcrete Block.</p> <p>2.5 Explain the properties of a point, a line and a plane in space.</p> <p>2.6 Locate given points, lines and planes in space on the projection planes.</p> <p>2.7 Determine the true length of a line in Space using</p>	Explain the concept of orthographic projections	Lecture notes, Drawings, Pictures, Power point, Projector.	Perform orthographic projections	Carryout orthographic projections	Drawing boards. Drawing instrument

	<p>(a) Auxiliary method (b) Rotational method.</p> <p>2.8 State practical applications of the methods in 2.7</p> <p>2.9 Apply successive auxiliary projections to determine:</p> <p>(a) The true position of a point to both horizontal and vertical planes (b) The true length of line inclined to both horizontal and vertical planes (c) The true shape of a plane inclined to both horizontal and vertical planes (d) The shortest distance between two lines inclined to the planes (e) The angle of inclination of a line inclined to two given planes.</p> <p>2.10 Explain dihedral angle and given examples of where it is commonly used: Hipped roofs, hoppers, etc.</p> <p>2.11 Determine the dihedral angle of two Intersecting surfaces.</p>					
General Objective 3.0: Understand the developments and intersections of regular solids and planes						
11-15	<p>3.1 Define developments 3.2 Develop patterns of regular solids such as truncated cylinder, frustrum of a pyramid truncated cone, etc. 3.3 Draw the lines of intersections of the following regular solid and planes in both first and third angles:</p> <p>(a) A cylinder meeting a square pyramid at right angle (b) A cylinder meeting a square pyramid at an angle (c) A cylinder meeting a cone, the cone enveloping the cylinder (d) a cylinder and a cone, the cylinder</p>	Describe the developments and intersections of regular solids and planes	Lecture notes, Drawings, Pictures, Power point, Projector.	Perform developments and intersections of regular solids and planes	Carryout developments and intersections of regular solids and planes	<p>Drawing boards.</p> <p>Drawing instrument</p>

	<p>enveloping the core</p> <p>(e) a square prism meeting a rectangular plane at an angle</p> <p>(f) a square prism meeting an ellipse at an angle in space</p> <p>(g) a square prism meeting a circle at an angle in space</p> <p>(h) a cylinder meeting a pentagon at an angle in space</p> <p>(i) a cylinder meeting an ellipse at an angle in space</p> <p>(j) a core meeting an ellipse at an angle in space</p> <p>(k) a circle cutting through a pyramid at an angle</p> <p>(l) an ellipse being enveloped by a pyramid at an angle. etc.</p> <p>3.4 Draw the patterns (developmental) of the Regular solids and planes in 3.3.</p> <p>3.5 Make models of the patterns referred to in 3.3</p>					
<p>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.</p>						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 102	Contact Hours: 2 – 0 - 1
Subject/Course: Introductory Hydrology		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 1 hours/week

General Objectives:

- 1.0 Understand the concept of Hydrologic Cycle**
- 2.0 Understand the components of weather and climate of a place.**
- 3.0 Understand precipitation as an important component of the hydrologic processes.**
- 4.0 Understand the basic concept of evaporation and transpiration.**
- 5.0 Know the basic concepts of run-off**
- 6.0 Understand the processes of infiltration and interception**
- 7.0 Understand the basic concept of underground water flow.**
- 8.0 Understand the basics of hydrograph**

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Introductory Hydrology		Course Code: WRE 102		Contact Hours: 2 – 0 - 1		
Course Specification:		Theoretical Content: 2 hrs		Practical Content: 1 hrs		
Year: ND I		Semester: 2		Prerequisite : ---		
Course Objectives 1.0: Understand the concept of Hydrologic Cycle						
Week	General Objective 1.0:					
1	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Define hydrology. 1.2 Explain the hydrologic cycle. 1.3 Outline the importance of the cycle in water resources development.	<ul style="list-style-type: none"> Lecture and illustrate with schematic diagram of hydrologic cycle. 	<ul style="list-style-type: none"> Instructional Manual. Recommended textbooks, lecture notes, PowerPoint, Projector & Screen, Magnetic Board, flip charts, Sketch of hydrologic cycle, 	<ul style="list-style-type: none"> Identify all elements of hydrologic cycle, Sketch the hydrologic cycle Compute the water balance. 	<ul style="list-style-type: none"> Develop practical manual Supervise practical activities Evaluate practical activities 	Practical manual
Week	General Objective 2.0: Understand the components of weather and climate of a place.					
2-3	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
	2.1 Distinguish between weather and climate. 2.2 Explain the effects of the following on weather and climate a. Latitude and longitude b. Earth rotation and revolution c. Amount, distribution and type of precipitation	<ul style="list-style-type: none"> Lecture and show the students the various instruments used in measuring weather elements 	<ul style="list-style-type: none"> Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint, Projector & Screen, 	▪	▪	▪

	<p>d. Temperature</p> <p>e. Wind-speed and direction</p> <p>f. Humidity</p> <p>g. Etc.</p> <p>2.3 Describe the various apparatus for measuring weather elements.</p> <p>2.4 Explain the factors responsible for the climate of a place.</p>		<ul style="list-style-type: none"> • Magnetic Board, flip charts, • Sketch of hydrologic cycle, • Different instruments used in measuring weather conditions, 			
Week	General Objective 3.0: Understand precipitation as an important component of the hydrological processes.					
4-5	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>3.1 Define precipitation</p> <p>3.2 Describe the formation of precipitation.</p> <p>3.3 Explain the types and mechanisms of formation of precipitation e.g. cyclonic, convective and orographic precipitation.</p> <p>3.4 Describe the mechanisms of formation of precipitations stated above.</p> <p>3.5 Distinguish between various forms of precipitation – drizzle, rain, glaze, sleet, snow and hail.</p> <p>3.6 Recognise the basic instruments for the measurement of precipitation.</p> <p>3.7 Outline the working and operation of rain gauges such as recording and non-</p>	<ul style="list-style-type: none"> • Lecture and sketch the diagrams of the various rain gauges. 	<ul style="list-style-type: none"> • Marker • board, • Rain gauges. 	<ul style="list-style-type: none"> • Carryout outdoor activities in siting a weather station, • Demonstrate the installation of rain gauge, • Demonstrate how to measure precipitation, • Show how to read precipitation chart, • Etc. 	<ul style="list-style-type: none"> • Develop practical manual for exercises. • Prepare practical as indicated in the manual. • Identify working components of rainfall recording and non-recording gauges 	<ul style="list-style-type: none"> • Practical manual, • Rainfall gauges of different types,

	recording gauge. 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. 3.11 Explain how to measure precipitation in an environment. 3.12 Describe rainfall intensity, frequency and duration, amount or depth of precipitation and areal extent.					
Week	General Objective 4.0: Understand the basic concept of evaporation and transpiration.					
6	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	4.1 Define evaporation and transpiration 4.2 Explain the factors affecting evaporation and transpiration.	Illustrate with good examples activities in 4.1 to 4.2 <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪
	4.3 Explain evapotranspiration 4.4 State the significance of evapotranspiration in water resources management.	Illustrate with good examples activities in 4.3 to 4.4.	Instructional Manual. Recommended textbooks, e-books, lecture notes,	<ul style="list-style-type: none"> • Demonstrate field measurement of evaporation and evapotranspiration. 	<ul style="list-style-type: none"> • Carry out field measurement of evaporation 	<ul style="list-style-type: none"> • Evaporation Pan • Lysimeter • Eddy covariance

		□ Assess the student	Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.		and evapotranspiration.	
Week	General Objective 5.0: Know the basic concepts of run-off					
7-8	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	5.1 Define run-off 5.2 Outline the factors affecting run-off 5.3 Explain various methods of runoff computation. 5.4 Explain rainfall-runoff relationship. 5.5 Relate quantity of run-off to watershed	<ul style="list-style-type: none"> ▪ Lecture ▪ Perform illustration by solving a calculation based problem 	<ul style="list-style-type: none"> ▪ Marker and board, ▪ PowerPoint ▪ Projector and screen, 	Demonstrate run-off from a given area by various methods. Use rainfall intensity – duration curve for computing run-off	Compute run-off from a given area by various methods. Use rainfall intensity – duration curve for computing run-off	Map/sketch of a given area, IDF curves
Week	General Objective 6.0: Understand the processes of infiltration and interception					
9	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	6.1 Define infiltration and interception. 6.2 Explain infiltration process 6.3 Recognise the factors affecting infiltration and interception. 6.4 Outline the methods of measuring infiltration, Describe the equipment of measuring infiltration.	<ul style="list-style-type: none"> ▪ Lecture ▪ Sketch the graph of infiltration rate against time. 	<ul style="list-style-type: none"> ▪ Marker board, ▪ infiltrometer. 	Estimate infiltration rate using various methods	Prepare students and equipments for the outdoor activity	Infiltrometer Measuring ruler Stopwatch Buckets
Week	General Objective 7.0: Understand the basic concept of underground water flow.					
10-11	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources

	7.1 Explain the characteristics of confined and unconfined groundwater, 7.2 Describe the basic groundwater flow equations,	<ul style="list-style-type: none"> ▪ Lecture ▪ Perform illustration ▪ Solving a calculation based problem 	Computer Software : <ul style="list-style-type: none"> ▪ MODFLOW ▪ FEFLOW ▪ MIKE SHE 	Use computer software to carryout groundwater flow simulation.	Prepare laboratory and computers	Computers and Softwares required
Week	General Objective 8.0: Understand the basics of hydrograph					
12-13	8.1 Define hydrograph 8.2 Describe the construction of hydrograph 8.3 Explain hydrograph separation techniques 8.4 Explain unit hydrograph 8.5 Explain simple applications of hydrograph	<ul style="list-style-type: none"> ▪ Lecture ▪ Illustrate the construction of hydrograph 	<ul style="list-style-type: none"> • Instructional Manual. • Textbooks, e-books, lecture notes, • Whiteboard, • PowerPoint, • Projector & Screen. 	<ul style="list-style-type: none"> ▪ Construct hydrograph and unit hydrographs ▪ Separate baseflow and direct flow in hydrograph 	Supply graph papers	Rainfall/flow data, graph sheets, ruler, pencils
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: CEC 104	Contact Hours: 2 – 0 - 2
Subject/Course: Science and Properties of Materials		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 2 hours/week

General Objectives:

- 1.0 Understand the internal structure of the atom.**
- 2.0 Understand the microstructure of solids.**
- 3.0 Understand the macroscopic properties of materials.**
- 4.0 Know various types and properties of aggregates used in Engineering Construction.**
- 5.0 Know types and properties of other materials used in Engineering Construction.**
- 6.0 Know the types and properties of cement.**
- 7.0 Understand the properties and uses of concrete.**
- 8.0 Know the Properties and uses of Ferro-cement**

	3.7 Define yield, plastic flow, creep. 3.8 Define conductors and semiconductors. 3.9 Describe dielectric, piezoelectric, and magnetic properties of solids.					
Week	General Objective 4.0: Know various types and properties of aggregates used Engineering Construction					
4-5	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
	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 4.1 to 4.9	O/H Projector, Marker board, writing tools, Plus Concrete Laboratory	Demonstrate the following tests: Sieve analysis, grading of aggregates, silt and clay tests, specific gravity, moisture contents in sands, Los Angelis abrasion test, Flakiness and Elongation, Aggregate impact value	Perform the following tests: Sieve analysis, grading of aggregates, silt and clay tests, specific gravity, moisture contents in sands, Los Angelis abrasion test, Flakiness and Elongation, Aggregate impact value	Set of standard sieves, , Los Angelis abrasion test machine, Flakiness and Elongation, Aggregate impact value machine Pyconometer
Week	9.0 General Objective 5.0: Know types and properties of other materials used in Engineering Construction.					
6-8	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	5.6 Describe types and properties of glass.	Describe, State. Carryout the	• O/H Projector,	Determine modulus of elasticity.	Lecturer to supervise	

	<p>5.7 Describe use and application of tar, bitumen and asphalt.</p> <p>5.8 State types and properties of asbestos.</p> <p>5.9 Define corrosion. State effects as well as prevention.</p>	<p>following tests on stabilized and non stabilized materials (field tests colour touch, luster, adhesion, washing, visual, water retention, dry strength, thread, ribbon, sedimentation, etc.)</p> <p>Laboratory tests (Linear shrinkage, wet sieving, siphoning, grain-size, atterberg limit, compaction, CBR etc).</p>	<ul style="list-style-type: none"> • Marker board, writing tools, • Plus Concrete Laboratory 	<p>Perform grading tests and crushing</p> <p>Strength tests on concrete.</p> <p>Carry out field tests on soils and laterite.</p> <p>Carry out laboratory tests on soil and laterite.</p>	<p>the lab. Work. Technologist is to demonstrate and allow students to carry out the tests. Reports are to be graded by Technologist.</p>	
General Objective 6.0: Know the types and properties of cement.						
9-10	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources

	<p>6.1 Distinguish between, the different types of cement.</p> <p>6.2 Describe the methods of cement manufacture.</p> <p>6.3 Describe the acceptability tests for cement, e.g fineness, setting time, soundness, based on BS EN 197-1: 2011.</p> <p>6.4 Perform the acceptability tests for cement.</p>	<ul style="list-style-type: none"> • Distinguish, Describe and classify cements based on BS EN 197-1: 2011 and ASTM C 150-12 standard consistence setting times test mortar cube test soundness, fineness specific gravity Concrete cube tests. 	<ul style="list-style-type: none"> • O/H Projector, • Marker board, writing tools, • Plus Concrete Laboratory 	<p>Carry out the following tests on a given cement sample:</p> <p>a. Consistency</p> <p>b. Initial and final setting time</p> <p>c. Soundness</p> <p>d. fineness</p> <p>e. mortar cube of sizes 70.5mm and 40mm x40mm x160mm.</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Vicat apparatus Le Chatelier test apparatus, • 150mm cube moulds, • 150mm cylindrical, • Engine oil • Curing tank fall of water. • DEMIC gauge Set of sieves
General Objective 7.0: Understand the properties and uses of concrete						
11-13	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>7.1 Describe, with illustrations, proper and improper storage of materials.</p> <p>7.2 Describe concrete batching, mixing and transporting methods.</p> <p>7.3 Describe standard tests for concrete e.g. slumps tests, compaction factor, compressive strength test (cube, cylinder).</p> <p>7.4 Perform standard tests in 7.3</p> <p>7.5 Describe types of concrete pumps, placers, vibrators, etc.</p> <p>7.6 Describe proper protection and curing of concrete.</p> <p>7.7 Describe, with illustration, the bending and fixing of</p>	<ul style="list-style-type: none"> • Describe, Define, State. 	<ul style="list-style-type: none"> • O/H Projector, • Marker board, writing tools, • Plus Concrete Laboratory 	<p>Perform the following tests on samples of concrete.</p> <p>a. Cast concrete cubes 12 in number and one cylindrical in shape.</p> <p>b. Cure in water</p> <p>c. Test 3 samples of cube after 7 days</p> <p>d. Test 3 samples of cube after 14 days</p> <p>e. Test 3 samples of cube after 28 days</p> <p>Compare results obtained with those specified in BS 12. Text the cylindrical</p>	<ul style="list-style-type: none"> • Illustrate 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 	<ul style="list-style-type: none"> • Vicat apparatus Le Chatelier test apparatus, • 150mm cube moulds, • 150mm cylindrical, • Engine oil • Curing tank fall of water. • DEMIC gauge

	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.			concrete after 28 days and obtain the modulus of elasticity of concrete.	collate the results of the graded practicals.	
General Objective 8.0: Know Properties and Uses of Ferrocement						
Week	Specific Learning Outcomes:	Teachers Activities	Resources	Specific Learning Outcomes:	Teachers Activities	Resources
14-15	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 liquid) retaining capacity. Etc. 8.5 Enumerate the guidelines for the use	State the minimum strengths for each by the standards.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	<p>of ferrocement.e.g. (a) Materials (b) Testing (c) Design (d) Construction.</p> <p>8.6 Discuss the criteria of choice of micro-reinforcement in concrete composites.</p> <p>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.</p> <p>8.8 Explain the properties of bamboo that make it useful in construction industry.</p> <p>8.9 Describe the construction of the following with bamboo:</p> <ol style="list-style-type: none"> a. split-bamboo piles (foundation) b. bamboo floor c. bamboo reinforced earth walls d. bamboo roofs structures e.g. <ol style="list-style-type: none"> 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 					
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ASSESSMENT: 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.

Competency The student shall have adequate knowledge and be able to conduct basic tests on civil engineering materials.

References: 1. Neville, A. M., Properties of Concrete, Prentice Hall, 5th Edition, 2012

2. Singh P., Civil Engineering Materials, S.K. Kataria & Sons

3. British Standard Institution, BS EN 197-1; BS EN 196 -1, BS EN 196-3, BS EN 196-6.

Department/Programme: ND Water Resources Engineering	Course Code: CEC 106	Contact Hours: 2 – 1 - 1
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Technology		
Subject/Course: Strength of Materials		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 1 hours/week

General Objectives:

- 1.0 Understand the behaviour of materials at stresses below and above elastic limit.**
- 2.0 Understand the properties of sections.**
- 3.0 Understand the basic principles of shearing force and bending moments**
- 4.0 Understand the principles of deflection.**
- 5.0 Understand the effect of torsion on circular section.**
- 6.0 Understand the use of Mohr's circles.**

PROGRAMME: WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Strength of Materials			Course Code: CEC 106		Contact Hours: 2 – 1 - 1	
Course Specification: Theoretical Content: 2 hrs			Tutorial : 1 hr		Practical Content: 1hrs	
Course Objectives: Students should be able to analyse problems in statistics and dynamics of structures.						
Week	General Objective 1.0: Understand the behaviour of materials at stresses below and above elastic limit.					
1	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	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, and soil.	Differentiate, Explain, Describe.	<ul style="list-style-type: none"> ▪ O/H projector, Whiteboard, writing materials. 	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 practical.	Universal testing machine, steel bar, venier callipers, steel tape, weighing machine. Concrete cube, compression machine weighing machine.
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	<ul style="list-style-type: none"> ▪ Tensometer ▪ Plastic deflection ▪ Apparatus 	Demonstrate elastic deflection of beams	Carry out elastic deflection of beams	

Week	General Objective 2.0: Understand the properties of sections.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3-4	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 inertia). 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.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Carry out shear force and Bending moment experiments	Show the students the steel I and T-hollow, channel sections. T-Reinforced concrete beam and rectangular beams should be shown to students.	Steel : I-section, Hollow rectangular and circular sections, steel T-sections
Week	General Objective 2.0: Understand the basic principles of shearing force and bending moments					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	3.1 Define shearing forces and bending moments with sign conventions. 3.2 Establish the relationship between the shearing force and bending moment.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Give assignments 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Carry out shear force and bending moment experiments		Shear force apparatus. Bending moment apparatus.

6-7	<p>3.3 Write expressions for shearing force and bending moment at a section of a loaded beam.</p> <p>3.4 Draw shear force and bending moment diagrams for any load beam (for various loading conditions)</p>	<p>Illustrate with good examples activities in 3.3 to 3.4.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>		<p>Draw shear force diagram and bending moment diagram of loaded beam</p>
8	<p>3.5 Calculate the points of contraflexure</p>	<p>Illustrate with good examples activities in 3.5</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>		
	<p>3.6 Calculate the moment of resistance.</p>	<p>Illustrate with good examples activities in 3.6.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>		
9	<p>3.7 Compute moments, flexural and shear stresses each separately at a given point on a section.</p> <p>3.8 Draw the stress distribution diagram at the section.</p>	<p>Illustrate with good examples activities in 3.7 to 3.8.</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes,</p>		

		<input type="checkbox"/> Assess the student	Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
Week	General Objective 4.0: Understand the principles of deflection.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
10	4.1 Explain deflection 4.2 Calculate deflection of beams and portal frames using simple methods.	Illustrate with good examples activities in 4.1 to 4.2 <input type="checkbox"/> Assess the student	Elastic deflection of beam apparatus Elastic deflection of frames	Evaluate deflection of beams and portal frames using simple methods.	Carry out experiment on deflection of beams and portal frames using simple methods.	Elastic deflection of beam apparatus. Deflection of beams apparatus Plastic deflection of frames Elastic deflection of frames.
Week	General Objective 5.0: Understand the effect of torsion on circular section.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11-12	5.1 Define torque, torsion, polar moment of inertia, angle of twist, modulus of rigidity 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.	<ul style="list-style-type: none"> ▪ Use laboratory models 	<ul style="list-style-type: none"> ▪ Torsion meter ▪ Unsymmetrical ▪ Cantilever apparatus 			Torsion testing equipment

	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.					
General Objective 6.0: Understand the use of Mohr's circles.						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
13	6.1 Describe Mohr's circles of (a) stress (b) strain. 6.2 Hoop's stress	Illustrate with good examples activities in 6.1 to 6.2. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Describe Mohr's circles of (a) stress (b) strain.	Draw Mohrs Circles	Pencil Paper
14	6.3 Compute stresses and strains by Mohr's circles including the concept of principal stresses.	Illustrate with good examples activities in 6.3. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
<p>ASSESSMENT: 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.</p> <p>Competency The student shall have adequate knowledge and be able to conduct basic tests on the strength of civil and water resources engineering materials.</p> <p>References: 1. Ryder, G. H., Strength of Materials, Macmillan Press Limited</p>						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 104	Contact Hours: 2 – 0 - 1
Subject/Course: Introduction to Geology		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 1 hours/week

General Objectives

- 1.0 Know the meaning of geology and methods of geological investigations in relation to water resources**
- 2.0 Understand the origin, structure and composition of the earth**
- 3.0 Know the types of rocks including the rock cycle, rocks structures and the surface process of the earth**
- 4.0 Understand the geology of Nigeria including the major geological basins and basement areas**
- 5.0 Understand the hydrological cycle and relate it to groundwater and the relevance to geology**
- 6.0 Understand groundwater level, aquifers, confined and unconfined aquifers, aquitards, aquifuge, aquiclude, porosity, transmissivity etc**
- 7.0 Know how to carry out geological study, draw geological and hydrogeological maps and interpretations**
- 8.0 Know basic methods of groundwater exploration especially geological and exploitation of groundwater**

	Course: Introduction to Geology	CODE: WRE 104	CONTACT HOURS: 2 – 0 - 1			
			Theoretical: 2 hrs/wk			
	Year: ND 1	Semester: 2nd	Pre-requisite: ----	Practical: 1 hr/wk		
Week	General Objectives 1.0: Know the meaning of geology and methods of geological investigations in relation to water resources					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
1-2	1.1 Explain geology and its relevance 1.2 Give the various methods of geological investigations 1.3 Relate the study of geology to water resources especially groundwater.	<ul style="list-style-type: none"> • Develop instructional manual for teaching this course. • Explain the subject of geology and link it to groundwater • Relate geology to water resources of the earth. • List the major areas of geology to water, mineral, oil, foundation studies etc 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	1. Draw and label position of geology to water resources, water exploitation, minerals, engineering structures etc 2. Indicate the composition of each of the three major zones of the internal structures	<ul style="list-style-type: none"> • Develop practical manual for fieldwork in this course. • Prepare practical as indicated in the manual 	Practical Manual. Drawing paper, pencils, ink, eraser, drawing board, reference chart of the earth's structure
	General Objective 2.0 Understand the surface processes of the earth					
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
3-4	2.1 Define weathering 2.2 Lists the types of weathering 2.3 Describe the mechanism of the processes in 2.1 2.4 Enumerate the importance of weathering 2.5 Describe hydrologic cycle 2.6 Define erosion 2.7 Describe the effect of erosion on terrains	<ol style="list-style-type: none"> 1. Explain physical and chemical weathering 2. List the surface and internal processes of the earth. 3. Explain the activities in 2.3 to 2.7 4. Enumerate the adverse effect and by-product of erosion, earthquake and volcanic eruptions 5. Evaluate the students. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	Field trip to see weathered rock in-situ and erosion sites	<ul style="list-style-type: none"> • Develop practical manual for laboratory/workshop exercises in this course. • Prepare practical as indicated in the manual 	Safety helmets, safety boots, first aid facilities, field vehicle, GPS, geological hammer, sample bags, topographic map

General Objective 3.0 Know the types of rocks including the rock cycle, rocks structures and know the surface process of the earth						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
5-6	3.1 Define rocks and explain the different types of rocks and structures 3.2 Define weathering Lists the types of weathering. 3.2 Describe the mechanism of the processes in weathering 3.4 Enumerate the importance of weathering 3.5 Define erosion Describe the effect of erosion on terrains and geological processes	<ul style="list-style-type: none"> • Explain the mechanisms involved in formation of rocks and their types. • Use the rock cycle to show the types of rocks • Explain rocks structures, lineaments, beddings etc • Explain weathering activities. • Explain the after effect of weathering and erosion on the environment 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	Field trip to see types of rocks and their classifications structures that occurs in the rocks should be mapped and simple geological map constructed etc. See weathering sites and let the students identify the sites. Identify erosion sites and relate to geological processes.	<ul style="list-style-type: none"> • Develop practical manual for as field guides and laboratory/work shop exercises in this course. • Prepare practical as indicated in the manual • Identify erosions and weathering sites. 	Practical Manual. Safety helmets, safety boots, first aid facilities, field vehicle, GPS, geological hammer, sample bags, topographic map
General Objective 4.0: Understand the geology of Nigeria including the major geological basins and basement areas						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
7-9	4.1 Explain with maps the geology and distribution of major rock types. 4.1 Explain the major sedimentary basins and their successions 4.2 Explain the basement complex in Nigeria and their rock types	<ol style="list-style-type: none"> 1. Explain the geology, the rock types and structures occurrences of Nigeria 2. Give details of rock types, distribution/locations in Nigeria using geological map 3. Present with the aid of a map geological basins and basement rocks 4. Evaluate the students 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, maps etc.	Draw geological maps of Nigeria to show the basement complex, sedimentary basins, meta-sediments and younger granites 2. Draw the hydrogeological maps of different parts of Nigeria	<ul style="list-style-type: none"> • Develop practical manual for fieldworks and exercises in this course. • Prepare practical as indicated in the manual 	Manual. Drawing paper, pencils, ink, eraser, drawing board

General Objective 5.0: Understand the hydrological cycle and relate it to groundwater and the relevance to geology						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
10	5.1 Explain the hydrologic cycle and the position of groundwater, surface water, evaporation, rainfall etc. 5.2 Define groundwater and explain the position of groundwater in the hydrologic cycle 5.3 Describe the importance of geology in the hydrologic cycle	1. Explain with diagram the hydrologic cycle and relate to groundwater, surface water, evapo-transpiration, seepages etc 2. Explain rock types and identify its relevance to groundwater occurrence	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	Draw the hydrologic cycle and identify its elements	Illustrate the components of the hydrologic cycle	Drawing paper, pencils, ink, eraser, drawing board
General Objective: 6.0: Understand groundwater terminologies						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
11	6.1 Explain groundwater terminology 6.2 Define aquifers, aquifuge, aquitards and aquicludes etc 6.3 Explain porosity, transmissivity	1. Explain the term aquifers, groundwater, confined and unconfined aquifers, aquitards, aquifuge and aquiclude. 2. Describe aquifers, aquitards, aquicludes 3. List factors responsible for good aquifers and water production. 4. Give examples of aquifers, aquitards, aquicludes etc	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	▪	▪	▪
General Objective: 7.0: Know how to carry out geological study, draw geological and hydrogeological maps and interpretations						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
12-13	7.1 Explain steps to carry	Explain geological maps	Instructional Manual.	Produce simple	• Develop	Manual.

	<p>out geological study, draw geological maps and interpret the maps</p> <p>7.2 Explain the usefulness of geological maps in water resources engineering</p> <p>7.3 Relate geological maps to water resources engineering</p> <p>7.4 Explain contour lines, orientation of maps, scale of maps, bearings.</p> <p>7.5 Explain the relationships between topography and geology</p>	<p>Describe how to use geological maps, cross sections</p> <p>Interpret geological maps and relate to contours, cross section etc.</p> <p>Explain maps orientations to cross section</p> <p>Let the students appreciate scales in map drawing and interpretations.</p>	<p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.</p>	<p>geological maps and give interpretations</p>	<p>practical manual for fieldworks and exercises in this course.</p> <ul style="list-style-type: none"> • Prepare practical as indicated in the manual 	<p>Drawing paper, pencils, ink, eraser, drawing board</p>
General Objective 8.0: Know the basic methods of groundwater exploration and exploitation						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
14	<p>8.1 Explain basic methods of groundwater exploration</p> <p>8.2 Explain groundwater exploitation based on geological exploration.</p> <p>8.3 Explain Basic construction methods for groundwater exploration.</p>	<p>Explain geological methods of geological investigations</p> <p>Show how the groundwater can be exploited through hand dug wells, boreholes, tube wells etc</p>	<p>Instruction Manual. Textbooks e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.</p>	<p>Field visits to hand-dug wells to see exploration criteria</p>	<p>Explain to students criteria for selection of sites. Students to identify sites based on the criteria</p>	<p>GPS, geological hammers, camera, note books, pencils</p>

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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 106	Contact Hours: 1 – 0 - 2
Subject/Course: Plumbing and Distribution Network		Theory: 1 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 2 hours/week

General Objectives

- 1.0 Know Safety in plumbing operations**
- 2.0 Understand practice in domestic plumbing**
- 3.0 Know plumbing tools, equipment and materials**
- 4.0 Know all operations to be carried out on pipes**
- 5.0 Know the principles of drainage and sanitation**
- 6.0 Understand the practice, operation and maintenance of distribution network**
- 7.0 Know procedures of leak detection and control**
- 8.0 Understand the writing of plumbing reports**

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING						
Course: Plumbing and Distribution Network			Course Code: WRE 106		Contact Hours: 1 – 0 - 2	
Course Specification:			Theoretical Content: 1 hr		Practical Content: 2hrs	
Course Objective 1.0: The course is designed to provide technical knowledge and skills to students on activities involved in domestic plumbing and distribution network.						
Week	General Objective 1.0: Know safety in plumbing operations					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1 - 2	1.1. Describe personal and general safety in plumbing operations 1.2.. Explain the safety and safety regulations 1.3. Enumerate safety signs. 1.4. Explain Safety in the workshop and on site. 1.5. Describe the procedure for handling hazardous substances, materials and processes. 1.6 Explain fire protection, prevention and control 1.7 Explain the procedure of applying First Aid	Illustrate with good examples activities in 1.1 to 1.7. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> ▪ Identify the name and uses safety equipment ▪ Explain safety signs on equipment 	<ul style="list-style-type: none"> • Provide practical manual • Demonstrate safety practices 	<ul style="list-style-type: none"> • Safety wears • First Aid kits • Safety signs • Safety equipment etc

Week	General Objective 2.0: Understand activities in domestic plumbing					
3 - 4	Specific Learning Outcome: 2.1. Explain the purpose of domestic plumbing 2.2. Describe the different types of domestic plumbing 2.3 Know basic plumbing symbols for domestic Water supply Network and sewerage 2.4. Draw pipe layout neatly complete with symbols and marks	Teachers Activities Illustrate with good examples activities in 2.1 to 2.4. <input type="checkbox"/> Assess the student	Resources Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Specific Learning Outcome: 1. Identify basic plumbing symbols 2. Sketch piping to an apartment 3. Draw pipe layout	Teacher Activities <ul style="list-style-type: none"> Provide practical workshop exercises 	Resources <ul style="list-style-type: none"> Plumbing symbols Practical manual Drawing material
Week	General Objective 3.0: Know plumbing tools, equipment and materials					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5	3.1 Name the different plumbing tools and their uses 3.2 Explain operation and maintenance of plumbing tools 3.3 Explain the operation and maintenance of plumbing equipments State the materials used in pipe and fittings and their applications	Illustrate with good examples activities in 3.1 to 3.4. <ul style="list-style-type: none"> <input type="checkbox"/> Assess the student 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	1. Identify plumbing tools 2. Demonstrate use of plumbing tools	<ul style="list-style-type: none"> Provide practical workshop exercises 	Different pipe materials and fittings Plumbing tools and accessories Plumbing equipment and accessories

Week	General Objective 4.0: Know general activities carried out on pipes					
6 - 7	Specific Learning Outcome: 4.1. Explain accurate measurement and cutting of different pipes 4.2. Explain the joining methods of different pipes with fitting and accessories 4.3 Describe the procedure for anchoring pipes 4.4 Describe the procedure for chiseling walls	Teachers Activities Illustrate with good examples activities in 4.1 to 4.4. <input type="checkbox"/> Assess the student	Resources Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Specific Learning Outcome: 1. Carry out pipe measurement and cutting 2. Carry out the joining of pipe with fittings 3. Carry out pipe anchoring wall chiseling	Teachers Activities <ul style="list-style-type: none"> Develop practical for workshop Demonstrate surface for conduit piping 	Resources Pipes, valves, measuring tapes, standing mobile vices, adhesive chisel etc
Week	General Objective 5.0: Know the principles of drainage and sanitation					
8 - 9	Specific Learning Outcome: 5.1 Explain drainage in domestic water system 5.2 Explain domestic drainage system 5.3 Explain the principles of sewage disposal 5.4 Describe the procedures of installation of sanitary appliances <ul style="list-style-type: none"> Enumerate steps in constructing drainages 	Teachers Activities Illustrate with good examples activities in 5.1 to 5.4. <input type="checkbox"/> Assess the student	Resources Instructional manual. Video Pictures	Specific Learning Outcome: 1. Show domestic drainage system 2. Demonstrate fixing various domestic plumbing receptacles 3. Install sanitary appliances	Teacher Activities <ul style="list-style-type: none"> Develop practical manual 	Resources <ul style="list-style-type: none"> WC WHB Bath, Pipes Valves Pipe wrenches Hacksaw Standing vices Fitting
General Objective 6.0: Understand the operation and maintenance of distribution network						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
10 - 11	6.1 Describe types of water distribution systems 6.2. Explain types and uses of pipe materials, joints, valves and fittings	Illustrate with good examples activities in 6.1 to 6.6.	<ul style="list-style-type: none"> Instructional manual. Video Pictures 	1. Identify different pipe materials, joints, and fittings 2. Clean and flush pipe network	Develop practical exercises on 6.1 and 6.2	<ul style="list-style-type: none"> Pipe materials Joints Fittings Valves

	6.3. Describe the different pipe network appurtenances 6.4 Explain the maintenance of pipe network and appurtenances. 6.5. Explain the operations and maintenance of surge tank and fire hydrant. 6.6. Describe methods of cleaning and flushing network distribution system.	<input type="checkbox"/> Assess the student		3. Test pipes for leaks and pressure loss		
General Objective 7.0: Know procedures of leak detection and control						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
12- 13	7.1 Discuss sources of leaks 7.2 Mention sources of leaks 7.2 Explain distribution maps and records 7.3 Describe methods of leak detection and control 7.4 Describe leak detection equipment 7.5 Explain leak repair and cleaning procedures after repair	Illustrate with good examples activities in 7.1 to 7.5. <input type="checkbox"/> Assess the student	<ul style="list-style-type: none"> • Instructional manual • Video • Pictures 	<ol style="list-style-type: none"> 1. Read Network distribution maps 2. Identify leak detection equipment 3. Carry out leak repair 	<ul style="list-style-type: none"> • Develop practical manual 	Distribution maps Leak detection equipment, Tool box etc
Week	General Objective 8.0: Understand plumbing reports					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
14	8.1 Explain plumbing proposals 8.2 Explain methods of quoting/estimating plumbing work 8.3 Discuss record keeping 8.4 Describe steps in writing plumbing reports.	Illustrate with good examples activities in 8.1 to 8.4. <ul style="list-style-type: none"> • <input type="checkbox"/> Assess the student 	<ul style="list-style-type: none"> • Instructional manual. • Video • Pictures 	<ul style="list-style-type: none"> • Write a sample plumbing proposal • Write quotation plumbing work 	Develop practical manual	Plumbing drawing
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: MTH 211	Contact Hours: 3 – 0 - 0
Subject/Course: Calculus		Theory: 3 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 0 hours/week

<p>General Objective:</p> <ol style="list-style-type: none"> 1.0 Understand the basic concepts of differential Calculus and in application in solving engineering problems, 2.0 Know integration as the reverse of differentiation and its application to engineering problems, 3.0 Understand first order homogenous linear ordinary equations with constant coefficients as applied to simple engineering problems 4.0 Understand the basic concepts of partial differentiation and apply same to engineering problems

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING						
COURSE : CALCULUS			Course Code: MTH 211		Contact Hours 3 – 0 - 0	
Course Specification:			Theoretical Content 3 hrs/week		Practical Content: 0 hrs	
Course Objectives: To learn the basics of Calculus						
Theoretical Content:			Practical Content:			
Week	General Objective: 1.0 Understand the basic concepts of differential Calculus and in application in solving engineering problems,					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1-4	1.1 Define limits with examples 1.2 State and prove basic theorems on limits 1.3 Prove that $\lim_{\theta \rightarrow 0} \sin \theta / \theta = 1$ 1.4 Define differentiation as an incremental notation or a function. 1.5 Differentiate a function from first principles. 1.6 Prove the formulae for derivative of functions, Function of a function, products, and quotient of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. 1.8 Derive second derivative of a function. 1.9 Apply differentiation to simple engineering and technological problems. 1.10 Explain the rate of change of a function 1.11 Explain the condition for turning point of a function. 1.12 Distinguish between maximum and minimum value of a function. 1.13 Sketch the graph of a function showing its	Teachers are to give and solve simple engineering and technological problems	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	<p>maximum and minimum points and points of inflexion.</p> <p>1.14 Estimate error quantities from the small increment of a function.</p> <p>1.15 Determine the tangent to a curve.</p> <p>1.16 Determine the normal to a curve.</p>					
Week	General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems,					
5-8	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>2.1 Define integration as the reverse of differentiation.</p> <p>2.2 Explain integration as a limit of summation of a function.</p> <p>2.3 Distinguish between indefinite and definite integrals.</p> <p>2.4 Determine the indefinite and definite integrals.</p> <p>2.5 Determine the definite integral of a function.</p> <p>2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions.</p> <p>2.7 List possible methods of integration.</p> <p>2.8 Integrate algebraic and trigonometric functions by the substitution method</p> <p>2.9 Integrate trigonometric and exponential functions by parts</p> <p>2.10 Integrate algebraic functions by partial fraction.</p> <p>2.11 Integrate trigonometric and logarithmic functions applying reduction formula.</p> <p>2.12 State standard forms of some basic integrals.</p>	<p>Ask students to apply integral calculus to simple function</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>▪</p>	<p>▪</p>	<p>▪</p>

	<p>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.</p> <p>2.14 Define Trapezoidal and Simpson=s rule as methods of approximating areas under given curves.</p> <p>2.15 Find approximate area under a curve applying Trapezoidal method.</p> <p>2.16 Find approximate area under a curve applying Simpson=s rule.</p> <p>2.17 Compare result obtained from Trapezoidal and Simpson=s rules with the results by direct integration</p> <p>2.18 Apply integration to kinematics.</p>					
Week	General Objective 3.0: Understand first order homogenous linear ordinary equations with constant coefficients as applied to simple engineering problems ,					
9-12	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>3.1 Define first order differential equation</p> <p>3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations.</p> <p>3.3 List examples of various types of first order differential equations.</p> <p>3.4 Define first order homogenous differential equations</p> <p>3.5 List the methods of solving differential equations by separable variables.</p> <p>3.6 Identify differential equations reducible to the homogenous form.</p>	Ask students to apply differential equation to solve engineering problems	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪

	<p>3.7 Explain exact differential equations.</p> <p>3.8 Solve exact differential equations, e.g. Show that $(3x^2 + y \cos x) dx + (\sin x - 4y^3) dy = 0$ is an exact differential equation; Find its general solution.</p> <p>3.9 Define integrating factors.</p> <p>3.10 Determine the solution of differential equations using integrating factors.</p> <p>3.11 Define linear differential equations of the first order.</p>					
Week	General Objective 4.0: Understand the basic concepts of partial differentiation and apply same to engineering problems					
13-15	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>4.1 Define partial differentiation</p> <p>4.2 List and explain the uses of partial derivatives.</p> <p>4.3 Solve problems on partial differentiation. e.g. $f(x, y) = x^2 + y^2 = 2xy$, find dy/dx, dx/dy</p> <p>4.4 Apply partial differentiation to engineering problems.</p>	Solve problems on partial differential	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: GNS 102	Contact Hours: 2 – 0 - 0
Subject/Course: Communication Skills II		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 0 hours/week

General Objectives:

On completion of the course the student should:

- 1.0 Understand the concept of communication.**
- 2.0 Know how to make oral presentations.**
- 3.0 Know the essential elements of correspondence.**
- 4.0 Know the rules of comprehension and interpretation.**

PROGRAMME: ND Water Resources Engineering Technology						
COURSE: Communication Skills II			COURSE CODE: GNS 102	CONTACT HOURS: 2 – 0 - 0		
GOAL: This course is designed to enable students acquire the necessary communication skills, know the techniques of correspondence and comprehend written materials.						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Understand the concept of communication.						
WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	1.1 Define communication. 1.2 Analyze the process of communication.	<ul style="list-style-type: none"> Define communication. Analyze the process of communication. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
2	1.3 Analyse the purposes of communication. 1.4 Explain the relationship between communication and language.	<ul style="list-style-type: none"> Analyse the purposes of communication. Explain the relationship between communication and language. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
3	1.5 Explain the impact of interference on communication at various levels, e.g. phonological, syntactic, etc. 1.6 Explain code-mixing, code-switching and dissonance in communication.	<ul style="list-style-type: none"> Explain the impact of interference on communication at various levels, e.g. phonological, syntactic, etc. Explain code-mixing, code-switching and dissonance in 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

		communication				
General Objectives: 2.0 Know how to make oral presentations.						
WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	
4	Oral Presentations 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.	<ul style="list-style-type: none"> Label a diagram of the organs of speech. Describe the functions of the organs in 2.1 above in speech production. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
5	2.3 List the phonemes of English. 2.4 Produce correctly each of the phoneme listed in 2.3 above.	<ul style="list-style-type: none"> List the phonemes of English. Produce correctly each of the phoneme listed in 2.3 above. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
6	2.5 Pronounce correctly by making distinctions between the different sound contrast in the consonantal and vowel systems of English.	<ul style="list-style-type: none"> Pronounce correctly by making distinctions between the different sound contrast in the consonantal and vowel systems of English. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
7	2.6 Explain the principles of effective speaking, viz, correct use of stress, rhythm, and intonation	<ul style="list-style-type: none"> Explain the principles of effective speaking, viz, correct use of 	Instructional Manual. Recommended textbooks, e-books, lecture notes,	▪	▪	▪

	patterns. 2.7 Read fluently.	stress, rhythm, and intonation patterns. • Read fluently.	Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
General Objectives: 3.0 Know the essential elements of correspondence.						
WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
8	Correspondence 3.1 List the various type of correspondence, e.g. letter, memo, circular, etc. 3.2 Explain the various parts of a letter.	<ul style="list-style-type: none"> List the various type of correspondence, e.g. letter, memo, circular, etc. Explain the various parts of a letter. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
9	3.3 Differentiate between formal and informal letter formats. 3.4 Explain the characteristics of styles suitable for formal and informal letters.	<ul style="list-style-type: none"> Differentiate between formal and informal letter formats. Explain the characteristics of styles suitable for formal and informal letters. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
10	3.5 Explain the functions of the first, middle and last paragraph. 3.6 Write a formal and an informal letter.	<ul style="list-style-type: none"> Explain the functions of the first, middle and last paragraph. Write a formal and an informal letter. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

General Objectives: 4.0 Know the rules of comprehension and interpretation.						
WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
11	4.1 Identify main ideas in a given passage. 4.2 Differentiate the main ideas from the details in a passage.	<ul style="list-style-type: none"> Identify main ideas in a given passage. Differentiate the main ideas from the details in a passage. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
12	4.3 Use the main idea to anticipate specific details in a passage. 4.4 Use context clues to aid comprehension.	<ul style="list-style-type: none"> Use the main idea to anticipate specific details in a passage. Use context clues to aid comprehension. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
13	4.5 Identify relationship patterns of ideas in a passage. 4.6 Use context clues such as definitions, restatements and examples to derive meaning.	<ul style="list-style-type: none"> Identify relationship patterns of ideas in a passage. Use context clues such as definitions, restatements and examples to derive meaning. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
14	4.7 Explain how affixes modify meanings. 4.8 Interpret figurative language in a passage.	<ul style="list-style-type: none"> Explain how affixes modify meanings. Interpret figurative language in a passage. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic	▪	▪	▪

			Board, flip charts, etc.			
15	4.9 Draw conclusions from available information.	<ul style="list-style-type: none"> Draw conclusions from available information. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: EEd 126	Contact Hours: 1 – 0 - 2
Subject/Course: Introduction to Entrepreneurship		Theory: 1 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 2 hours/week

General Objectives:

On completion of the course, the student should:

- 1. Understand the meaning and scope of Enterprise and Entrepreneurship**
- 2. Understand the history and Government Policy measures at promoting Entrepreneurship in Nigeria**
- 3. Understand the types, characteristics and rationale of Entrepreneurship**
- 4. Understand the role of Entrepreneurship in economic development**
- 5. Understand Entrepreneurial characteristics and attitude**
- 6. Understand the key competencies and determining factors for success in Entrepreneurship**
- 7. Know the motivational pattern of Entrepreneurs**

DEPARTMENT/PROGRAMME: ND Water Resources Engineering Technology						
COURSE: Introduction to Entrepreneurship		Course Code: EEd 126		Contact Hours: 1 – 0 - 2		
GOAL: This course is designed to enable students acquire the necessary Entrepreneurship skills to be self reliant.						
Theoretical Content				Practical Content		
General Objective 1: Understand the meaning and scope of Enterprise and Entrepreneurship						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	<p>1.1 Define an Enterprise in its narrower and wider contexts.</p> <p>1.2 Explain different forms of Enterprises</p> <p>1.3 Classify the different forms of enterprises into small, medium and large enterprises.</p> <p>1.4 Explain the terms: Entrepreneur, Entrepreneurship, Wage Employment, Self Employment</p> <p>1.5 Explain clearly the business terrain in Nigeria</p>	<p>I. Explain the terms: Enterprise, Entrepreneur, Entrepreneur-ship</p> <p>II. List the different types of enterprises and group them into small, medium and large enterprises.</p> <p>III. Compare and Contrast wage employment and self-employment.</p> <p>IV. Explain clearly the business terrain in Nigeria</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>Identify features of the types of enterprises identified.</p> <p>Identify the facilities and opportunities available for self employment.</p> <p>Identify successful entrepreneurs in Nigeria.</p> <p>Evaluate the role of entrepreneurship in wealth creation.</p>	<p>Guide students to research into different forms of enterprises.</p> <p>Guide students to research and identify criteria for successful entrepreneurship.</p> <p>Establish competitive groups.</p> <p>Students to make formal presentations of their findings.</p> <p>Students to undertake</p>	<p>Successful Entrepreneur to speak on the role and importance of Entrepreneurship</p> <p>Use of internet and relevant video clips</p>

					enquiry learning on selected entrepreneur and enterprise	
Theoretical Content				Practical Content		
General Objective 2: Understand the History and Government Policy measures at promoting Entrepreneurship in Nigeria						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
3-4	<p>2.1 Trace the evolution of entrepreneurship development</p> <p>2.2 Compare Entrepreneurship in Nigeria with Japan, India, China, Malaysia, South Korea etc.</p> <p>2.3 Explain Nigeria's values in relation to Entrepreneurship.</p> <p>2.4 Describe the role of Entrepreneurship in the development of enterprises.</p>	<p>I. Explain the historical development and role of entrepreneurship in the development of enterprises in Nigeria.</p> <p>II. Compare Entrepreneurship in Nigeria with other countries of the world. Japan, India, China, Malaysia, South Korea.</p> <p>III. Show students video film on Entrepreneurship development in any of the countries mentioned above.</p> <p>IV. Explain Nigeria's values and</p>	<p>Text Books</p> <p>Journals</p> <p>Publications</p> <p>Video Film</p> <p>TV & VCR</p>	Obtain the required information from the net.	<p>Guide students to search the web for the historical evolution of entrepreneurship in other parts of the world</p> <p>Research and list various Government Measures on SME's and Industrial Development from 1960 to date.</p>	Internet

		Entrepreneurship.				
Theoretical Content				Practical Content		
General Objective 3: Understand the types, characteristics and rationale of Entrepreneurship						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
5-6	3.1 Explain types of Entrepreneurs and their characteristics 3.2 Compare and contrast Technological and Social Entrepreneurship. 3.3 Identify the different types of Entrepreneurs: self employed, Opportunistic, Inventors, Pattern multipliers etc. 3.4 Identify the role of Entrepreneurship in business, society and in self employment.	I. Explain types of Entrepreneurs. II. Explain types of Entrepreneurship III. Explain features of Entrepreneurship in business. IV. Explain the rewards and efforts of Entrepreneurship in business. V. Describe the different types of Entrepreneurs. VI. Describe the role of entrepreneurship in business, society employment generation and wealth creation. VII. Explain the benefits of self employment.	Text Books, K.A.B Journals Publications Video Film TV & VCR	Analyze life situations people may find themselves in. Enumerate the benefits to be derived from the above situation.	Guide students to identify opportunities from the environment.	Internet Textbooks Journals

Theoretical Content				Practical Content		
General Objective 4: Understand the role of Entrepreneurship in economic development.						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
7-8	4.1 Identify resources and constraints of Entrepreneurship 4.2 Explain how Entrepreneurship leads to import substitution and utilization of local resources. 4.3 Explain how Entrepreneurship leads to socio-economic development 4.4. Explain the role of an entrepreneur in grassroot / local economic development	I. Explain resources and constraints of an Entrepreneur. II. Relate import substitution to utilization of local resources. III. Explain equitable distribution of industries and the role of entrepreneurship. IV. Explain how entrepreneurship leads to job creation.	Text Books Journals Publications Video Film TV & VCR	Classify the resources into economic, human, knowledge and time. Distinguish between economic development and economic growth	Show transparency of the resources needed by an entrepreneur. Guide students to visit selected enterprise/community projects. Guide students on the use of local raw materials for value addition.	Computer or Overhead Projector SME's
Theoretical Content				Practical Content		
General Objective 5: Understand Entrepreneurial Characteristics and Attitudes						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
	5.1 Explain the philosophy, values, scope, need and characteristic of Entrepreneurship. 5.2 Explain the profiles of local Entrepreneurs.	I. Using slide or PowerPoint explain personal characteristics and attitude of an Entrepreneur II. List Entrepreneurial	Text books Journals Computer Projector	Evaluate the opportunities identifying corresponding self employment opportunities. Evaluate a project considering its	Guide students to identify as many job/ employment opportunities as possible. Guide students to visit a successful enterprise, and	Computer Projector Guest speakers (Female/Male) Internet search.

<p>9-11</p>	<p>5.3 Demonstrate high sense of innovation, creativity and independence.</p> <p>5.4 Explain the process of acquiring high sense of information seeking and ability in operating an enterprise.</p> <p>5.5 Identify various risks and remedies involved in operating an enterprise.</p> <p>5.6 Evaluate pilot project considering resources, time, personnel, equipment, money, materials etc.</p> <p>5.7 Demonstrate leadership and leadership skills by mobilizing resources for establishing an enterprise.</p> <p>5.8 Demonstrate high level problem solving techniques in overcoming internal and external</p>	<p>traits citing relevant cases.</p> <p>III. Explain the aspiration, determination and efficiency of an Entrepreneur.</p> <p>IV. Explain how to demonstrate high sense of innovation, creativity and independence.</p> <p>V. Describe how to evaluate a private project.</p> <p>VI. Describe how to mobilize resources for establishing an enterprise.</p> <p>VII. Describe how to solve problems involving internal and external constraints.</p>		<p>resources: management of time, personnel, equipment and money.</p> <p>Explain constraints and problem solving techniques.</p>	<p>evaluate its resources to identify its contribution to economy, its internal and external constraints and available problem solving techniques.</p> <p>Group students to survey and interview Entrepreneurs.</p> <p>Evaluate a sample project with the students, then give them assignment to assess one.</p>	
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	constraints.					
Theoretical Content				Practical Content		
General Objective 6: Understand the key competencies and determining factors for success in Entrepreneurship						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
12-13	<p>6.1 Identify the key competencies required in setting up a successful small business; Knowledge, Skill and Traits.</p> <p>6.2 Identify key success factors in setting up a small business; Resources, Ability, Motivation and Determination, Idea and Market etc.</p> <p>6.3 Define individual life goal and link it to Entrepreneurship.</p> <p>6.4 Identify the strengths and weaknesses in 6.3 above.</p> <p>6.5 Explain business games.</p> <p>6.6 Explain the behavioral pattern observed in 6.5 above on: Moderate</p>	<p>I. Explain major competencies required for successful Entrepreneurship</p> <p>II. Explain key success factors in setting up small business.</p> <p>III. Explain individual life goal of an Entrepreneur.</p> <p>IV. Explain relevant business games and their behavioral patterns.</p>	<p>Text Books</p> <p>Journals</p> <p>Publications</p> <p>Video Film</p> <p>TV & VCR</p>	<p>Describe: Data collection about self, Who am I (personal efficacy) Rating of concept, Self knowledge.</p> <p>Play a relevant business game and observe the behavioral pattern in relation to moderate risk taking, goal setting etc.</p> <p>Identify core skills, competencies, and success factors required for entrepreneurship.</p>	<p>Guide student to demonstrate knowledge of themselves, goals, Entrepreneurship strengths and weaknesses.</p> <p>Give practical assignment to students on personal efficacy, goal and link to Entrepreneurship strength and weaknesses.</p> <p>Demonstrate how to play business game.</p> <p>Visit a small business enterprise.</p>	<p>Computer and accessories, internet and visitations. Blocks Rings Papers</p>

	risk taking, Goal setting, Learning from feed back, Taking personal responsibility, Confidence and self reliance.					
Theoretical Content				Practical Content		
General Objective 7: Know the motivational pattern of Entrepreneurs						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
14-15	7.1 Define motivation. 7.2 List the objectives of motivation. 7.3 Identify barriers to motivation and achievement. 7.4 Explain Thematic Appreciation Test (TAT) scores. 7.5 Explain how to analyze motive strength from TAT score. 7.6 Explain the spirit of Achievement Motivation Test (AMT)	I Explain motivation, objectives, merit and demerit. II Explain TAT scores. III Explain how to carryout analysis on motive strength from TAT scores. IV. Explain spirit of AMT	Text Books Journals Publications	Analyze motive strength from TAT score using a given case.	Illustrate how to carryout analysis on motive strength from TAT scores using related case studies.	Computer and internet facilities.
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 108	Contact Hours: 2 – 0 - 1
Subject/Course: Basic Soil Mechanics		Theory: 2 hours/week
Year: ND I Semester: 2nd	Pre-requisite:	Practical: 1 hours/week

GENERAL OBJECTIVES:

- 1.0 **Understand the concepts of soil mechanics and classification of soils**
- 2.0 **Understand the principle of compaction**
- 3.0 **Understand Darcy's Law and permeability in soil**
- 4.0 **Know shear strength of soils and application for the determination bearing capacity**
- 5.0 **Understand the compressibility and settlement of soils.**

Course: Basic Soil Mechanics		Course Code: WRE 108			Contact Hours: 2 – 0 - 1	
Course Specification: Theoretical Content: 2 hrs				Practical Content: 1 hr		
Course Objectives: This course is to acquaint students with knowledge for them to have a good base in soil mechanics necessary in Water Resources Engineering						
Week	General Objective 1.0: Understand the concepts of soil mechanics and classification of soil					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1 – 4	1.1 Define soil mechanics. 1.2 Differentiate between engineering soil and other soil types. 1.3 State the roles of soil in Engineering. 1.4 Explain classification of soil 1.5 Describe the properties of soils es (Void Ratio, Porosity, Moisture, etc.).	<ul style="list-style-type: none"> ▪ Define soil mechanics ▪ Show the differences between engineering soil and other types of soils ▪ Classify soil with the use of grain size, consistency limits, hydrometer analysis etc. ▪ Illustrate soil with the use of phase diagram to show porosity, void ratio, etc. 	<ul style="list-style-type: none"> • White board, markers, charts and specialized graph sheets 	<ul style="list-style-type: none"> • Carry out soil classification tests, e.g., identification, specific gravity, sieve analysis, consistency limits, moisture content, hydrometer analysis. 	<ul style="list-style-type: none"> • Demonstrate specific gravity, sieve analysis, hydrometer and combined analysis, consistency limits tests 	<ul style="list-style-type: none"> • Set of sieves, soil hydrometer, sieve shaker, weighing balances (manual and electronic), liquid limit devices, drying oven, etc
Week	General Objective 2.0: Understand the principle of compaction					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5 – 6	2.1 Explain the compaction of soil. 2.2 Describe the different methods of compaction. 2.3 Explain the different forms of field control compaction characteristics.	<ul style="list-style-type: none"> • Explain the compaction of soil. • Explain the different forms of field control during compaction. • Explain the B.S, modified AASHO and West African standards of compaction 	<ul style="list-style-type: none"> • White board, markers, charts and specialized graph sheets 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪

	2.4 Explain the three standard compaction tests.	tests				
Week	General Objective 3.0: Understand Darcy's Law and permeability in soil					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7 – 9	<p>3.1 Know the principles of hydrostatic and excess hydrostatic pressures, and hydraulic gradient.</p> <p>3.2 Explain the principles of Darcy's Law</p> <p>3.3 Know the constant head and falling head permeability.</p> <p>3.4 Know methods of measuring the permeability of a soil in the field.</p>	<ul style="list-style-type: none"> • Explain hydrostatic and excess hydrostatic pressures in soil. • Explain and calculate the hydraulic gradient. • Describe the principles of Darcy's Law. • Describe the falling and constant head permeability tests. • Explain how to measure permeability on the field. 	Instructional manual, white board, markers, charts.	▪	▪	▪
Week	6.0 General Objective 4.0: Know shear strength of soils and application for the determination bearing capacity					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
10 – 11	<p>4.1 Know the Mohr-Coulomb shear strength equation defining all terms in it.</p> <p>4.2 Enumerate the basics of direct shear test.</p> <p>4.3 Enumerate the basics of triaxial test (Drained and</p>	<ul style="list-style-type: none"> • Explain the Mohr-Coulomb equation defining all the terms. • Define the direct shear parameters. • Show how the direct shear parameters are used to calculate bearing capacity. 	White board, markers, charts and graph sheets	▪	▪	▪

	Undrained) 4.4 Define the bearing capacities of soil. 4.5 Compute bearing capacity using C and θ .	<ul style="list-style-type: none"> • Explain the drained and undrained triaxial compression tests. • Explain how the bearing capacity of soil is determined using the C and θ. 				
Week	General Objective 5.0: Understand the compressibility and settlement of soils.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
12 – 13	5.1 Know the two methods used in determining consolidation settlement. 5.2 Know the types of settlement (immediate, consolidation and Creep).	<ul style="list-style-type: none"> • Describe the Taylor’s Square Root and the Log of Time methods of determining consolidation. • Explain immediate and creep settlement. 	Instructional manual, white board, markers, charts and specialized graph sheets	▪	▪	▪
ASSESSMENT: The continuous assessment, tests and quiz (including practical reports) 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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: ICT 119		Contact Hours: 1 – 0 - 2
	Subject/Course: Introduction to Computing			Theoretical: 1 hours/week
	Year: 1	Semester: 2	Pre-requisite:	Practical: 2 hours /week

General Objectives

1. **Know history and uses of a computer system.**
2. **Know Windows operating system.**
3. **Understand file management in Windows/ Mac OS, concept of a software packages and printing.**
4. **Know Word-Processing packages.**
5. **Know graphic packages.**
6. **Know spreadsheet package.**
7. **Know the use of a database package.**
8. **Know how to use the internet to retrieve and upload information.**

	Course: Introduction to Computing	Course Code: ICT 119		Contact Hours: 1 – 0 - 2		
				Theoretical: 1 hours/week		
	Year: Semester:	Pre-requisite:		Practical: 2 hours /week		
	Theoretical Content			Practical Content		
	General Objective 1: Know history and uses of a computer system.					
Week/s	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1 - 2	1.1 Define what is meant by a computer. 1.2 Know the history of computer development (briefly) 1.3 State the uses of computers and understand the impact of the PC on computer technology. 1.4 Differentiate between hardware and software 1.5 Understand the input-process-output algorithm (hardware)	<ul style="list-style-type: none"> ▪ Define what is meant by a Computer? ▪ Teach the history of Computer development s. (Briefly) ▪ Teach the uses of computers and the impact of PC on the society: home, office, 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪

	<ul style="list-style-type: none"> a. Central processor b. Input mechanisms c. Output mechanisms d. Central processor e. Input mechanisms f. Output mechanisms 	banks etc.				
	<p>1.6 Explain how data is stored</p> <ul style="list-style-type: none"> a. RAM b. ROM c. Fixed discs d. Removable discs <p>1.7 Understand the concept of an operating system</p> <ul style="list-style-type: none"> a. PC-DOS/MS-DOS b. Windows c. Linux d. Unix e. PC-DOS/MS-DOS f. Windows g. Linux h. Unix 	<p>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.</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪

General Objective 2: Know Windows operating system						
3	▪	▪	▪	<p>2.1 Access computers correctly through Windows operating system.</p> <ol style="list-style-type: none"> a. Open/Close a window b. Program Manager c. Button bars/scroll bars/menu bars d. Moving from one window to another e. Open/Close a window f. Program Manager g. Button bars/scroll bars/menu bars 	<p>Discuss the advantage of the Windows Operating System.</p> <p>Demonstrate 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.</p>	<p>For 1 Stream of Students, provide at least 30 Computers (with Pentium IV, 2GB RAM, 80GB HDD with optical drive, 1.5GHz Processor, Windows or Mac OS)</p>

				h. Moving from one window to another		
General Objective 3: Understand file management in Windows/ Mac OS, concept of a software packages and printing.						
4	▪	▪	▪	<p>3.1 Demonstrate file management;</p> <p>a. Creating a file and folder</p> <p>b. Manipulating files (moving, copying, saving, deleting)</p> <p>c. Print manager</p> <p>d. Creating a file and folder</p> <p>e. Manipulating files (moving, copying, saving, deleting)</p> <p>f. Print manager</p>	Show the process of creating a file, manipulating the file and use of the print manager to print documents.	<p>For 1 Stream of Students, provide at least 30 Computers (with Pentium IV, 2GB RAM, 80GB HDD with optical drive, 1.5GHz Processor, Windows or Mac OS).</p> <p>Laser Jet Printer (at a maximum of 4 students to 1 printer).</p> <p>1 Ream of A4 papers to 10 students.</p> <p>4 tonners per printer per semester.</p>

	▪	▪	▪	<p>3.2 Demonstrate the concept of software packages;</p> <ol style="list-style-type: none"> MS Office Lotus Smartsuite MS Encarta MS Office Lotus Smartsuite MS Encarta 	<p>Load MS Office with the students and describe the various packages that make up MS Office. Load MS Encarta and discuss its use with the students.</p>	<p>For 1 Stream of Students, provide at least 30 Computers (with Pentium IV, 2GB RAM, 80GB HDD with optical drive, 1.5GHz Processor, Windows or Mac OS). Laser Jet Printer (at a maximum of 4 students to 1 printer). 1 Ream of A4 papers to 10 students. 4 tonners per printer per semester.</p>
General Objective 4: Know Word-Processing packages.						
5 - 6	▪	▪	▪	<p>4.1 Demonstrate the ability in using word-processing package such as MS Word (or equivalent standard)</p> <ol style="list-style-type: none"> Entering text Formattin g text (embolde 	<ul style="list-style-type: none"> ▪ Install MS Word. ▪ 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. ▪ Plot graphs and charts. 	<ul style="list-style-type: none"> - For 1 Stream of Students, provide at least 30 Computers (with Pentium IV, 2GB RAM, 80GB HDD with optical drive, 1.5GHz Processor, Windows or Mac OS). - Laser Jet Printer (at a maximum of 4 students to 1

				<p>ning, font size, italicising)</p> <p>c. Creating and Saving text files</p> <p>d. Editing and moving text</p> <p>e. Importing objects</p> <p>f. Spelling and Grammar Checking</p> <p>g. Creating and manipulating tables, text boxes, equations</p> <p>h. Printing</p> <p>i. Entering text</p> <p>j. Formatting text (embolden</p>		<p>printer).</p> <ul style="list-style-type: none"> - 1 Ream of A4 papers to 10 students. - 4 tonners per printer per semester.
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				ning, font size, italicising) k. Creating and Saving text files l. Editing and moving text m. Importing objects n. Spelling and Grammar Checking o. Creating and manipulating tables, text boxes, equations p. Printing		
General Objective 5: Know graphic packages.						
7 - 8	▪	▪	▪	5.1 Demonstrate the ability in using graphic package such as Corel	▪ Load Corel Draw. ▪ Show features of the software. ▪ Show creating and	▪ Maximum of 4 students to 1 computer ▪ Maximum of 4

				<p>Draw (or equivalent standard)</p> <ol style="list-style-type: none"> 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 	<p>saving of images.</p> <ul style="list-style-type: none"> ▪ Edit saved images. ▪ Export the graphics to other packages. ▪ Show how to re-size images. 	<p>computers to a printer except when a Net work is in use.</p> <ul style="list-style-type: none"> ▪ 1 Ream of A4 papers to 10 students. ▪ 4 Ink cartridges per printer per semester.
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				<p>file standard (JPEG, PCX, GIF etc)</p> <ul style="list-style-type: none">i. Printingj. Drawing toolsk. Text as graphicsl. Creating and saving image filesm. Editing and moving imagesn. Importing and exporting graphicso. Windows 'Clipboard' facilityp. Creating and manipulat ing images (re-sizing	
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				etc) q. Image file standard (JPEG, PCX, GIF etc) r. Printing		
General Objective 6: Know spreadsheet package.						
9 - 11	▪	▪	▪	Demonstrate the ability in using 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) d. Creating and saving	<ul style="list-style-type: none"> ▪ Load MS Excel. ▪ Show features of the software. ▪ Create a worksheet and edit it. ▪ Show how to format a work space. 	<ul style="list-style-type: none"> ▪ 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 cartridges per printer per semester.

				<p>worksheets</p> <ul style="list-style-type: none">e. Creating a formula in cellsf. Importing objectsg. Exporting the worksheeth. Creating and manipulating graphical representations of datai. Printingj. Setting up the worksheetk. Entering datal. Formatting data (decimal places, alpha-numeric)		
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				<ul style="list-style-type: none"> m. Creating and saving worksheets n. Creating a formula in cells o. Importing objects p. Exporting the worksheet q. Creating and manipulating graphical representations of data r. Printing 		
General Objective 7: Know the use of a database package.						
12 - 13	▪	▪	▪	Demonstrate the ability in using a database package such as MS Access/MySQL (or equivalent standard)	<ul style="list-style-type: none"> ▪ Load MS Access/MySQL. ▪ Show the features and working of the software. ▪ Use students record as example and enter the 	<ul style="list-style-type: none"> ▪ Maximum of 4 students to 1 computer. ▪ MySQL Software. ▪ Maximum of 4 computers to a printer except when a Net

				<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> records in the structure query modify and produce typical report. ▪ Show how to index and sort files in alphabetical order. 	<ul style="list-style-type: none"> work is in use. ▪ 1 Ream of A4 papers to 10 students. ▪ 4 Ink cartridges per printer per semester.
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				<ul style="list-style-type: none"> j. Drawing tools k. Text as graphics l. Creating & saving image files m. Editing & moving images n. Importing & exporting graphics o. Windows 'Clipboard' facility p. Creating & manipulating images (re-sizing etc) q. Image file standards (JPEG, PCX, GIF etc) r. Printing 	
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General Objective 8: Know how to use the internet to retrieve and upload information.						
14 - 15	▪	▪	▪	<p>Demonstrate how to use the internet to retrieve and upload information.</p> <ol style="list-style-type: none"> World Wide Web (WWW) Download information Paste retrieved information into an appropriate application Use e-mail to send and receive messages. National and international e-mail E-mail attachments (sending 	<p>Show students how to</p> <ul style="list-style-type: none"> ▪ surf the Internet. ▪ Write and send an email. 	<ul style="list-style-type: none"> ▪ 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 cartridges per printer per semester. ▪ Internet connectivity.

				<ul style="list-style-type: none"> & receiving) g. World Wide Web (WWW) h. Download information i. Paste retrieved information into an appropriate application j. Use e-mail to send and receive messages. k. National and international e-mail l. E-mail attachments (sending & receiving) 		
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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.

Competency: The student should be expose to understand basic computer programming.

Reference: **Chapra, S.C. and Canale, R.P. “Introduction to Computing for Civil Engineers, McGraw hill, 1994**
Press, W.H., Teukolsky, S.A., Vetterling, W.T. and Fannery, B.P. “Numerical recipes”. Cambridge Univ. Press, 1993.

Department/Programme: ND Water Resources Engineering Technology	Course Code: SUG 208	Contact Hours: 1 – 0 - 3
Subject/Course: Engineering Surveying I		Theory: 1 hours/week
Year: ND II Semester: 1st	Pre-requisite:	Practical: 3 hours/week

General Objectives:

- 1.0 Understand the basic principles and scope of engineering surveying.**
- 2.0 Understand the basic principles of geometric design of routes.**
- 3.0 Know how to set out routes consisting of straight and circular curves**
- 4.0 Understand the methods of running, calculating, plotting and drawing longitudinal sections and cross sections.**
- 5.0 Understand methods of area computations**
- 6.0 Understand methods of volumes computations.**
- 7.0 Understand the process of setting out structures**
- 8.0 Understand the specialized aspects of “as built” surveys.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Engineering Surveying I		Course Code: SUG 208		Contact Hours: 1 – 0 - 3		
Course Specification: Theoretical Content: 1 hrs				Practical Content: 3 hrs		
Course Objectives :The student on completion of this course should understand and apply basic principles of surveying to engineering projects						
Week	General Objective 1.0: Understand the basic principles and scope of engineering surveying.					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher 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.	Illustrate with good examples activities in 1.1 to 1.7 ■ □ Assess the student	■ Whiteboard ■ OHP ■ Charts ■ Picture ■ Video ■ Maps	■	■	■
Week	General Objective 2.0: Understand the basic principles of geometric design of routes.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
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	Illustrate with good examples activities in 2.1 to 2.3	■ Maps ■ Drawings ■ Pictures	■	■	■

	design requirements of roads, railways, pipelines, electric power lines, etc.	<ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 				
Week	General Objective 3.0: Know how to set out routes consisting of straight and circular curves					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3-5	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. 3.5 Derive necessary formulae to set out circular curves by deflection angles. 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.	Illustrate with good examples activities in 3.1 to 3.7 <ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 	<ul style="list-style-type: none"> ▪ Total Station ▪ Theodolite 	<ul style="list-style-type: none"> ▪ Set out a long circular curve by deflection angles using successive instrument stations. 	Carry out setting out a long circular curve by deflection angles using successive instrument stations.	<ul style="list-style-type: none"> ▪ Total Station ▪ Theodolite
Week	General Objective 4.0: Understand the methods of running, calculating plotting and drawing longitudinal sections and cross sections.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6-7	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	Illustrate with good examples activities in 4.1 to 4.8	<ul style="list-style-type: none"> ▪ Digital levels ▪ Engineer's level 	Carry out ranging, leveling, and calculation, plotting and drawing of longitudinal section and cross sections at 30m intervals of a	Demonstrate the procedure for tacheometric survey.	Theodolite, staff, total station.

	<p>4.4 Describe the methods of leveling the longitudinal section.</p> <p>4.5 Illustrate methods of booking sectional observation.</p> <p>4.6 Reduce the levels of all points and plot longitudinal section and cross sections.</p> <p>4.7 Explain the essential difference between the plot of longitudinal section and cross section.</p> <p>4.8 Explain why in practice cross sections are usually taken at intervals.</p>	<ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 		<p>proposed road alignment.</p> <p>Carry out simple circle ranging.</p> <p>Carry out Tacheometric Survey of the School of Engineering.</p> <p>Range and set out cross sections</p>		
Week	General Objective 5.0: Understand methods of area computations					
8-9	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>5.1 Distinguish between rectilinear and irregular areas.</p> <p>5.2 Describe the methods of obtaining the area using formulae for geometric figures.</p>	<p>Illustrate with good examples activities in 5.1 to 5.2</p> <ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>Carry out area computation of the School of Engineering with regular boundaries.</p> <p>5.3 Use the planimeter.</p> <p>5.4 Calculate areas by the trapezoidal and by Simpson's rules.</p> <p>5.5 Compare the methods of area calculations.</p>	<ul style="list-style-type: none"> ▪ Divide area into grids of equal width. Use area method to explain the calculation using simpson, rule, and other methods including the planimeter. 	<ul style="list-style-type: none"> ▪ Planimeter , drawing paper, Pencil, eraser. ▪ Calculators.
	General Objective 6.0: Understand methods of volumes computations.					
10-11	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>6.1 Explain the need for calculation of volumes of earthworks.</p> <p>6.2 Derive the trapezoidal and prismoidal formulae.</p>	<p>Illustrate with good examples activities in 6.1 to 6.5</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-</p>	<ul style="list-style-type: none"> • Produce contoured plan using, theodolite along with leveling staff level 	<ul style="list-style-type: none"> ▪ Demonstrate the use of theodolite in obtaining 	<ul style="list-style-type: none"> ▪ Drawing paper, Pencil, Eraser.

	<p>6.3 Calculate volumes from 6.2 above.</p> <p>6.4 Calculate volumes from contour lines.</p> <p>6.5 Calculate volumes from spot heights.</p>	<ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 	<p>books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>with tape and staff.</p> <ul style="list-style-type: none"> ▪ Carry out volume computation of earth works with cut and fill and draw mass haul diagram. 	<p>heights.</p> <ul style="list-style-type: none"> ▪ Ditto using levels. ▪ Lecturer to provide data from a survey. ▪ Demonstrate how to obtain areas of cut and fill from cross-section. Explain how 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. 	<ul style="list-style-type: none"> ▪ Theodolite, level, tapes, staff.
General Objective: 7.0 Understand setting in out procedure for a medium sized building including.						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
12	<p>7.1 Explain how to set-out a building and the accompanying constraints.</p> <p>7.2 Explain how profiles are used to</p>	<ul style="list-style-type: none"> ▪ Explain how setting out differs from ordinary surveying. ▪ Lecture, 	<ul style="list-style-type: none"> ▪ Theodolite ▪ Total Station ▪ Optical Plumb 	<ul style="list-style-type: none"> ▪ Identify the equipment required to set-out a building with 	<ul style="list-style-type: none"> ▪ Demonstrate the procedure for tertiary leveling along 	<ul style="list-style-type: none"> ▪ Levels, pegs, tape. ▪ Theodolite

	<p>control.</p> <p>7.3 Determine the areas of a building and its site.</p> <p>7.4 Explain how running internal and external measurements are taken horizontally and vertically.</p> <p>7.5 State the procedure for checking vertically a building using Theodolite, Optical Plumb, and Plumb-bob.</p> <p>7.6 Describe the invert of a drain, a sight rail and a traveler.</p> <p>7.7 Calculate suitable length of a traveler and reduced levels of sight rails from given drawings.</p> <p>7.8 Establish sight rails for horizontal and depth control of a straight drain between manholes.</p> <p>7.9 Explain the survey terms used in road construction.</p> <p>7.10 Describe methods of route surveying.</p> <p>7.11 Describe the types of control used for embankments, cuttings and levels.</p> <p>Calculate volumes of cut and fill on a given straight road with transverse sloping ground.</p> <p>Describe the forms of horizontal and vertical controls needed by the setting out process.</p> <p>7.3 Determine plans required for setting out.</p> <p>7.12 Describe all the stages of setting out engineering</p>	<ul style="list-style-type: none"> ▪ Illustrate site practice with slides or photographs. 	<p>Plumb-bob</p>	<p>accompanying access roads.</p> <ul style="list-style-type: none"> ▪ Construct profiles and datum for a building. ▪ Identify the instruments used for taking internal and external dimensions. ▪ Determine spot levels and survey detail by tacheometer working out accuracies attainable in various methods of optical distance measurements. ▪ Plot datum to scale and prepare a contour drawing. ▪ Carry out tertiary leveling, reduction and adjustment to produce elevations of all permanent stations along a circuit of about 5kms. ▪ Undertake a service 	<p>a circuit.</p>	<p>te staff.</p> <ul style="list-style-type: none"> ▪ Total Station ▪ Digital theodolite
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	structures			of setting out exercises, e.g. for a small building.		
				<ul style="list-style-type: none"> ▪ Set out building/structure 		
13	General Objective 8.0: Understand the specialized aspects of “as built” surveys.					
	8.1 Explain the need for “as built” surveys. 8.2 Identify the requirements of as “built” surveys.	Illustrate with good examples activities in 8.1 to 8.2 <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> ▪ Carry out the methods of surveying for existing and new works as finally constructed. 		
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 201	Contact Hours: 2 – 0 - 1
Subject/Course: Hydraulics		Theory: 2 hours/week
Year: ND II Semester: 1st	Pre-requisite: WRE 107	Practical: 1 hours/week

General Objectives	
1.0	Understand principles of Hydrostatics
2.0	Understand principles of fluid flow.
3.0	Understand the importance of uniform flow in open channel.
4.0	Understand the importance of non-uniform flow in open channel
5.0	Understand the importance of unsteady flow.

PROGRAMME: ND Water Resources Engineering Technology						
Course: Hydraulics		Course Code: WRE 201			Contact Hours: 2 – 0 - 1	
Course Specification:		Theoretical Content: 2 hrs		Practical Content: 1 hrs		
Course Objectives : Understand fundamental principles of Hydraulics						
Week	General Objective 1.0: Understand principle of Hydrostatics					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1-2	1.1 Explain hydrostatics in relation to pressure in fluids. 1.2 Explain pressure measurements. 1.3 Explain Pressure forces on submerged bodies 1.4 Explain Floatation	Illustrate with good examples activities in 1.1 to 1.4 ▪ <input type="checkbox"/> Assess the student	▪ Marker, board, Drawings, Charts ▪ OHP	Carry out pressure measurements	Prepare the lab and equipment	Hydraulics bench
	General Objective 2.0: Understand principles of fluid flow.					
Week	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3-6	2.1 Explain classification of flows. 2.2 Explain the principle of conservation of matter 2.3 Explain the principle of conservation of energy. 2.4 Explain the principle of conservation of momentum 2.5 Explain the Continuity equation. 2.6 Explain the Bernoulli Energy equation. 2.7 Explain velocity and discharge measurements. 2.8 Explain Pitot – Static tube	Illustrate with good examples activities in 2.1 to 2.11 ▪ <input type="checkbox"/> Assess the student	Marker, whiteboard, PowerPoint, projector etc	1. Investigate Laminar and turbulent flow in a pipe with applications.	▪ Set up the lab equipment, Coordinate the practical activities	Flow measuring apparatus, flow channels, Hydraulic bench, permeability tanks, Reynolds and transitional flow apparatus, Surge and water Hammer apparatus, Drainage/ seepage tank

	<p>application in velocity measurements.</p> <p>2.9 Understand discharge through a small Orifice,</p> <p>2.10 Understand Laminar flow in Pipes.</p> <p>2.11 Understand Turbulent flow in Pipes</p>					
General Objective 3.0: Understand the importance of uniform flow in open channel.						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7- 8	<p>3.1 Explain mean flow velocity in uniform flow</p> <p>3.2 Define shear</p> <p>3.3 Understand Darcy-Weisbach's Equation</p> <p>3.4 Understand Chezy's and Mannings Equations</p> <p>3.5 Know the factors affecting velocity distribution</p>	<ul style="list-style-type: none"> ▪ Lecture and apply the two equations to solve uniform flow problems 	<ul style="list-style-type: none"> ▪ White board, marker, Drawings, Charts ▪ Pictures ▪ OHP 	<p>Determine head – discharge relationship for</p> <p>a) rectangular notch</p> <p>b) V-notch</p>	<ul style="list-style-type: none"> ▪ Set up the lab equipments, Coordinate the practical activities 	<p>Rectangular flow channel with provision for flow depth measurement.</p>
General Objective 4.0: Understand the importance of non-uniform flow in open channel						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
9 – 10	<p>4.1 Explain the application of energy and momentum principles.</p> <p>4.2 Define specific energy</p> <p>4.3</p>	<p>Illustrate with good examples activities in 4.1 to 4.5</p> <ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the 	<ul style="list-style-type: none"> ▪ Marker, whiteboard, Drawings, Charts ▪ OHP 	<p>Carryout experiment on hydraulic jump</p>	<p>Set up the lab equipments, Coordinate the practical activities</p>	<p>Rectangular Channel and accessories</p>

	<p>explain equation for critical depth</p> <p>4.4 define hydraulic-jump.</p> <p>4.5 explain physical concept of hydraulic-jump and its location.</p>	student				
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General Objective 5.0: Understand the importance of unsteady flow.

Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11-13	<p>5.1 Describe the application of unsteady flow equations in channels, rivers, backwater curves, and similitude.</p> <p>5.2 Describe the application of dimensional analysis in solving basic hydraulic problems.</p>	<p>Illustrate with good examples activities in 5.1 to 5.2</p> <ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 	<ul style="list-style-type: none"> ▪ Whiteboard, marker, Drawings, Charts ▪ OHP 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪

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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 207	Contact Hours: 1 – 0 - 1
Subject/Course: Hydrometeorology		Theory: 1 hours/week
Year: ND II Semester: 1st	Pre-requisite: WRE 102	Practical: 1 hours/week

<p>General Objectives</p> <p>1.0 Understand the fundamentals of meteorology</p> <p>2.0 Understand the basics of hydrometeorology</p> <p>3.0 Understand the basics of measurement of meteorological parameters, installation and maintenance of hydrometeorological instruments</p> <p>4.0 Understand the basics of rainfall data analysis</p> <p>5.0 Describe data validation, and determination of missing data</p> <p>6.0 Understand the concept of evaporation measurement and computation</p> <p>7.0 Understand the nature of evaporating surfaces, and the different methods of measuring evaporation.</p>
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PROGRAMME: ND Water Resources Engineering Technology						
COURSE: Hydrometeorology			Course Code: WRE 207		Contact Hours: 1 – 0 - 1	
Course Specification: Theoretical Content: 1 hr				Practical content: 1 hrs		
Week	General Objective 1.0: Understand the fundamentals of meteorology.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
1-2	1.1 Explain hydrometeorology 1.2 Describe the composition and structure of the atmosphere. 1.3 Explain radiation, emission and absorption laws 1.4 Explain radiation budget 1.5 Describe atmospheric circulation 1.6 Explain the formation of clouds and precipitation 1.7 Explain the weather and climate patterns of an area.	1. Lecture 2. Use charts for illustrations 3. Solve calculation based problems 4. Demonstrate the applications of equations.	White Board, Computers, Related Software, Power Point Projector, Flip Charts, Recommended Textbooks, Related Journals and Lecture Notes, Drawing tools, etc.	▪	▪	▪
Week	General Objective 2.0: Understand the basics of hydrometeorology					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
3– 4	2.1 Define hydrometeorology. 2.2 Describe meteorological stations. 2.3 Describe hydrometeorological parameters and instruments of measurement. 2.4 Discuss the needs and requirements for hydro-meteorological networks	1. Lecture 2. sketch meteorological station 3. Show samples of meteorological instruments	Meteorological instruments: rain gauge, thermometers, Pans, etc.	▪	▪	▪

Week	General Objective 3.0 : Understand the basics of measurement of meteorological parameters, installation and maintenance of hydrometeorological instruments					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
5-6	3.1 explain the procedures of installation and maintenance of instruments 3.2 describe how to measure various meteorological parameters 3.3 explain the procedures of maintenance of instruments 3.4 state the advantages and disadvantages of the instruments. 3.5 explain data recording in the proper format	1. Lecture 2. Show the installation and maintenance of instruments 3. Show how to measure the parameters 4. Provide data record format	Hydrometeorological instruments, etc.	1. Carry out outdoor activities on installation and maintenance of instruments. 2. Carryout outdoor activities on measurement of meteorological parameters	<ul style="list-style-type: none"> ▪ Prepare the instruments ▪ Provide the record format 	
Week	General Objective 4.0: Understand the basics of rainfall data analysis					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
7-9	4.1 describe the methods of rainfall data analysis: e.g. i) Arithmetic mean method. ii) Thiessen's method iii) Isohyetal method iv)	1. Lecture 2. Show analysis using a sample data 3. Demonstrate the plotting of curves	White Board, Computers, Power Point Projector, Flip Charts, Recommended Textbooks, Related Journals Lecture Notes, Drawing tools, etc.	1. Compute rainfall data using various formulas 2. Draw different related charts and curves.	1. Prepare related equations/models for data analysis	White Board, Projector, Flip Charts, practical manual and drawing tools,

	v) intensity of precipitation vi) duration of precipitation vii) frequency of precipitation depth – Area – Duration curve					
Week	General Objective 5.0: Describe data validation, and determination of missing data					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
10-11	5.1 Explain mass curve and its construction 5.2 Discuss the methods of determining missing data 5.3 Discuss the applications of mass curve and missing data determination	1. Lecture 2. Demonstrate with charts and drawings 3. Solve calculation related problems	Arithmetic graph sheet, white board, power point projector, flip charts, recommended textbooks, lecture notes, drawing tools,	1. Construct rainfall mass curve 2. Determine missing data	<ul style="list-style-type: none"> • Prepare rainfall data • Provide necessary graph sheets 	Arithmetic Graph Sheet, Projector, Flip Charts, practical manual, etc.
Week	General Objective 6.0: Understand the concept of evaporation measurement and computation					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
12-13	6.1 Describe the process of Evaporation. 6.2 Explain the methods of evaporation measurement 6.3 Describe how to compute evaporation from open water surface 6.4 Describe the computation of evapotranspiration	1. Lecture 2. Compute evaporation 3. Compute evapotranspiration	White Board, Power Point Projector, Flip Charts, Recommended Textbooks, Related Journals and Lecture Notes, Drawing tools, etc.	1.0 Carry out evaporation measurement by different methods 1.0 Calculate evaporation and evapotranspiration	Prepare weather station for exercise	Evaporation pan

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.

Department/Programme: ND Water Resources Engineering Technology	Course Code: CEC 205	Contact Hours: 2 – 1 - 0
Subject/Course: Theory of Structures I		Theory: 2 hours/week
Year: ND II Semester: 1st	Pre-requisite: CEC 106	Practical: 0 hours/week

General Objective:

- 1.0 Know the different methods of computing slope and deflection.**
- 2.0 Know the principles for the stability of dams, retaining walls and chimneys.**
- 3.0 Understand indeterminacy in beams.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Theory of Structures I		Course Code: CEC 205		Contact Hours: 2 – 1 - 0		
Course Specification: Theoretical Content: 2 hrs		Tutorial : 1 hrs		Practical Content: 0 hrs		
Course Objectives: The course is designed to enable the student analyse various mechanisms and structures.						
Week	General Objective 1.0: Know the different methods of computing slope and deflection.					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1	1.1 Calculate member forces in simple frames using the tripod and shear legs coefficients - methods.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
2	1.2 Compute slope and deflection of simple beams and cantilever by double integration methods.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
3	1.3 Compute slope and deflection of simple beams and cantilever by area- moment methods.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
4	1.4 Compute deflection of simple frames using Williot-Mohr and analytical methods.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
Week	General Objective 2.0: Know the principles for the stability of dams, retaining walls and chimneys					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5	2.1 Calculate over-turning moment, centres for given dams, retaining walls and	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture 	Whiteboard Charts Drawing	▪	▪	▪

	chimneys.	<ul style="list-style-type: none"> ▪ Give assignments ▪ Show examples 	Design examples			
6	2.2 Calculate sliding forces for given dams, retaining walls and chimneys.	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
Week	General Objective 3.0: Understand indeterminacy in beams.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7	Introduction to indeterminate Structures. 3.1 Define determinate, indeterminate structures and explain the concept of redundance. 3.2 Determine the degree of indeterminacy in beams and frame. 3.3 The use of coefficients for solving indeterminate structure	<ul style="list-style-type: none"> ▪ Use question and answer techniques ▪ Lecture ▪ Give assignments ▪ Show examples 	Whiteboard Charts Drawing Design examples	▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: CEC 207	Contact Hours: 1 – 0 - 1
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Subject/Course: Hydro-Geology		Theory: 1 hours/week
Year: ND II Semester: 1st	Pre-requisite:	Practical: 1 hours/week

General Objectives:

- 1.0 Understand the occurrences of ground water distribution and their uses.**
- 2.0 Understand factors that affect water movement in soils.**
- 3.0 Know the principles of groundwater investigation/exploration.**
- 4.0 Understand the principles of groundwater exploitation.**
- 5.0 Understand the chemical characteristics of groundwater.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Hydro-geology			Course Code: CEC 207		Contact Hours: 1 – 0 - 1	
Course Specification: Theoretical Content: 1 hrs			Practical Content: 1 hrs			
Week	General Objective 1.0: Understand the occurrences of ground water distribution and their uses.					
1-2	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Explain the occurrences of groundwater	<ul style="list-style-type: none"> • Explain the occurrences of groundwater 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc..	<ul style="list-style-type: none"> • Site visit to ground water sources • Visit construction sites 	<ul style="list-style-type: none"> • Develop practical manual for fieldworks and exercises in this course. • Prepare practical as indicated in the manual • Develop manual and filed visit guides 	Geological maps, geological hammer, GPS, compass
	1.2 Describe how groundwater resources can be used.	<ul style="list-style-type: none"> • Explain the usage of groundwater 				
	1.3 Describe how groundwater affects engineering construction.	<ul style="list-style-type: none"> • Explain how groundwater affects engineering construction 				
Week	General Objective 2.0: Understand factors that affect water movement in soils					
3-6	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	2.1 Name the factors that affect the movement of water in soils.	<ul style="list-style-type: none"> ▪ Explain factors affecting the movement of water in soils. ▪ Explain different types of aquifer. ▪ Explain flow patterns in aquifers 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen,	▪	▪	▪
	2.2 Define each of the factors in 2.1 above.					
	2.3 Define aquifers					
	2.4 List different types of aquifers (aquiclude, aquitard, aquifuge)					
	2.5 Illustrate flow patterns in					

	different types of aquifers.		Magnetic Board, etc.			
Week	General Objective 3.0: Know the principles of groundwater investigation/exploration.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7	3.1 Name the different types of groundwater investigation techniques	<ul style="list-style-type: none"> Explain different types of groundwater investigation techniques. 	Instructional Manual. <ul style="list-style-type: none"> Recommended textbooks, e-books, lecture notes, Whiteboard PowerPoint Projector, Screen, Magnetic Board, etc. 	<ul style="list-style-type: none"> Demonstrate and collect field data from resistivity and other techniques. Interpret field data using manual and computer interpretations 	Carry out resistivity method. Interpret field data	Resistivity meter, cable, battery, computer etc.
8	3.2 Explain each of the types in 3.1 above, e.g, electrical and electromagnetic seismic retraction etc.	<ul style="list-style-type: none"> Explain electrical resistivity, seismic, electro-magnetic etc, filed methods and interpretation. 	Instructional Manual. <ul style="list-style-type: none"> Recommended textbooks, e-books, lecture notes, Whiteboard PowerPoint Projector, Screen, Magnetic Board, etc. 	Demonstrate and collect field data from resistivity and other techniques. Interpret field data using manual and computer interpretation	Carry out resistivity method. Interpret field data	Resistivity meter, cable, battery, computer etc
Week	General Objective 4.0: Understand the principles of groundwater exploitation.					
9	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning	Teacher Activities	Resources

				Outcome:		
	4.1 Define water table 4.2 Explain the factors that affect aquifer yield.	<ul style="list-style-type: none"> ▪ Explain water table with diagram ▪ Solve calculations based problem to illustrate well hydraulics. 	<ul style="list-style-type: none"> • Instructional Manual. • Recommended textbooks, e-books, lecture notes, Whiteboard PowerPoint Projector, Screen, Magnetic Board, etc 	▪	▪	▪
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,.	<ul style="list-style-type: none"> • Explain the various methods of ground water exploitation 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
11	4.4 Know various drilling equipment	<ul style="list-style-type: none"> • Explain the various drilling equipment and their uses 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard,	▪	▪	▪

			PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
12	4.5 Describe methods of artificial recharge.	Explain artificial recharge	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
Week	General Objective 5.0: Understand the chemical characteristics of groundwater.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
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 preventing groundwater pollution and contamination.	<ul style="list-style-type: none"> ▪ Explain sources of impurities in groundwater ▪ Identify the sources of pollution. ▪ Explain methods of preventing groundwater pollution to wells e.g grouting, deep placement of screens 	<ul style="list-style-type: none"> • Instructional Manual. ▪ Recommended textbooks, e-books, lecture notes, Whiteboard PowerPoint Projector, 	Carryout practical exercises on 5.1 – 5.3. Carryout an excursion to pollution site	Prepare relevant guides on the visit and explain the different sources of pollution	<ul style="list-style-type: none"> • Transportation. • Field water quality testing equipment

		etc.	Screen, Magnetic Board, etc.			
<p>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.</p> <p>Competency: Students expected to have in depth knowledge of ground water location, movement, quality and harnessing Techniques.</p> <p>Reference:</p> <ol style="list-style-type: none"> 1. Hydrogeology (1959) Wister G. O. John Wiley 2. Hydrogeology (1966) Davis S.W. John Wiley 						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: CEC 209		Contact Hours: 1 – 0 – 3
	Subject/Course: Civil Engineering Drawing I			Theoretical: 1 hours/week
	Year: II	Semester: 1st	Pre-requisite: MEC 102	Practical: 3 hours /week

General Objectives:

1. **Know the drawing office practice and know layout of drawing.**
2. **Understand building layout orientation**
3. **Know the production of Civil Engineering drawings in standard Format**
4. **Understand the view of two and three storey buildings with basement in detail.**
5. **Understand reinforced concrete structural detailing.**

	Course: Civil Engineering Drawing I	Course Code: CEC 209		Contact Hours: 1 – 0 – 3		
				Theoretical: 1 hours/week		
	Year: Two Semester: One	Pre-requisite: MEC 102		Practical: 3 hours /week		
	Theoretical Content			Practical Content		
	General Objective 1: Know the drawing office practice and know layout of drawing.					
Week/s	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1	1.1 Explain the functions of personnel and equipment in the drawing office.	Describe the functions of personnel and equipment in the drawing office.	Lecture notes, Whiteboard/ White board, Marker, Projector	Produce the layout for an engineering office.	Demonstrate and supervise the students to produce the layout for an engineering office.	Drawing boards and equipment. Paper
	2.1 Explain line drawing layout and pictorial information.	Describe line drawing layout and pictorial information.	Lecture notes, Whiteboard/ White board, Marker, Projector	Produce information essential for full communication between designer and contractor i.e. tile block.	Demonstrate and supervise the students to produce information essential for full communication between designer and contractor i.e. tile block.	Drawing boards and equipment. Paper
	General Objective 2: Understand building layout orientation					
2	3.1 Define site plan layout and bearings. 3.2 Explain building orientation with respect to sun and wind.	<ul style="list-style-type: none"> • Explain site layout and bearings. • Describe building orientation with respect to sun and wind. 	Lecture notes, Whiteboard/ White board, Marker, Projector	▪	▪	▪

	General Objective 3: Know the production of Civil Engineering drawings in standard Format					
3 - 4	<p>4.1 Explain the drawing equipment and materials used in Civil Engineering drawing.</p> <p>4.2 Describe treatment of lettering and drawing pencil and ink.</p> <p>4.3 Use scale drawings and survey drawings, in traditional operations code etc.</p> <p>4.4 Describe conventional methods of indications and representations of architectural and structural detailing in plan, elevation and sections of buildings and building components.</p> <p>4.5 Explain the principles of perspective projection.</p>	<ul style="list-style-type: none"> List the drawing equipment and materials used in Civil Engineering drawing. Discuss the treatment of lettering and drawing using pencil and ink. Discuss conventional methods of indications and representations of architectural and structural detailing in plan, elevation and sections of buildings and building components. Discuss principles of perspective projection. 	Lecture notes, Whiteboard/ White board, Marker, Projector	▪	▪	▪
	General Objective 4: Understand the view of two and three storey buildings with basement in detail.					
5 - 6	<p>5.1 Explain the plan, elevations and sectional views.</p> <p>5.2 Explain working details of special features including</p>	<ul style="list-style-type: none"> List the plan, elevations and sectional views. 	Lecture notes, Whiteboard/ White board, Marker,	<ul style="list-style-type: none"> Draw the plan, elevations and sectional views. 	Carryout practicals on items listed in 5.1 – 5.3.	Drawing boards and equipment. Paper

	<p>stairs.</p> <p>5.3 Explain underground floor building on slope.</p> <p>5.4 Expose students to interpretation of working drawing.</p>	<ul style="list-style-type: none"> List the working details of special features including stairs. Discuss underground floor building on slope. 	Projector	<ul style="list-style-type: none"> Draw working details of special features including stairs. Draw underground floor building on slope. Expose students to interpretation of working drawing. 		
General Objective 5: Understand reinforced concrete structural detailing.						
7 - 15	<p>6.1 Explain a typical reinforced concrete floor plan showing grid notation.</p> <p>6.2 Explain a reinforced concrete structural element e.g. beams, columns, cut the section.</p> <p>6.3 Explain full reinforced concrete details of structural elements, viz, foundation, columns, beams, slabs, cantilever lintels and stairs.</p> <p>6.4 Explain bending schedule of bars in reinforced concrete elements.</p> <p>6.5 Explain the detailing of reinforced concrete structural building</p>	<ul style="list-style-type: none"> Sketch and explain a typical reinforced concrete floor plan showing grid notation. Sketch and explain a reinforced concrete structural element e.g. beams, columns, cut the section. Explain full reinforced concrete details of structural 	Lecture notes, Whiteboard/ White board, Marker, Projector	<ul style="list-style-type: none"> Draw a typical reinforced concrete floor plan showing grid notation. Draw reinforced concrete structural elements e.g. beams, columns, cut the section. Draw full reinforced concrete details of structural elements, viz, foundation, columns, beams, 	Carryout practicals on items listed in 6.1 – 6.6.	Drawing boards and equipment. Paper, Computer (30 Nos) with AutoCAD installed.

	6.6 Explain the use of CAD to produce the drawing in 6.5 above	<p>elements, viz, foundation, columns, beams, slabs, cantilever lintels and stairs.</p> <ul style="list-style-type: none"> • Explain bending schedule of bars in reinforced concrete elements. • Explain the detailing of reinforced concrete structural building • Explain the use of CAD to produce the drawing in the above 		<p>slabs, cantilever lintels and stairs.</p> <ul style="list-style-type: none"> • Prepare bending schedule of bars in reinforced concrete elements. • Undertake the detailing of reinforced concrete structural building • Use CAD to produce the drawing in the above 		
<p>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.</p>						

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. Bangash, “Structural Details in Concrete” Blackwell.

2. R.L. Fullerton “Building Construction in Warm Climate” 2nd Ed. Oxford U.P. Vol. 2, 1983.

Department/Programme: ND Water Resources Engineering Technology	Course Code: WRE 205	Contact Hours: 2 – 0 - 2
Subject/Course: Construction of Hydraulic Structures		Theory: 2 hours/week
Year: ND II Semester: 1st		Practical: 2 hours/week

General Objectives:

- 1.0 Understand Earth embankments**
- 2.0 Understand Earth works**
- 3.0 Understand Site selection and preliminary investigations.**
- 4.0 Understand the procedure of Earth Dam construction**
- 5.0 Know finishing works**
- 6.0 Understand concrete reservoir (ground and overhead)**
- 7.0 Understand intake structure (head works)**
- 8.0 Understand water treatment plant**

PROGRAMME: WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Construction of Hydraulic Structures			Course Code: WRE 205		Contact Hours: 2 – 0 - 2	
Course Specification:			Theoretical Content: 2 hrs		Practical Content: 2hrs	
Goal of the Course: Understand construction of an Earth dam.						
Week	General Objective 1.0: Understand Earth embankments					
1	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Know embankments 1.2 Know the different types of embankment 1.3 Explain Cutoff trench and core.	Illustrate with good examples activities in 1.1 to 1.3 ▪ <input type="checkbox"/> Assess the student	Teaching tools. (Pictures and video)	Identify earth dam	Visit earth dam	Logistics on transportation of students
Week	General Objective 2.0: Understand Earthworks.					
2 - 3	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	2.1 Know suitable borrow areas for earth dam construction. 2.2 Describe suitable borrow areas.	<ul style="list-style-type: none"> • Lecture • Explain borrow pits 	Borrow areas Auger etc	Identify borrow pit	Visit borrow pit	Logistics on transportation of students
	2.3 Understand soil classification. 2.4 Understand soil compaction	Illustrate with good examples activities in 2.3 to 2.4. <input type="checkbox"/> Assess the student	Teaching Tools.	Analyze samples for soil properties	Provide test manual	Soil testing equipments

Week	General Objective 3.0: Understand Site selection and preliminary investigations.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4 - 5	3.1 Understand preliminary surveys 3.2 Determine most suitable site from potential sites.	Illustrate with good examples activities in 3.1 to 3.2. □ Assess the student	<ul style="list-style-type: none"> • Maps • Teaching Tools. • Level, • Theodolite 	Identify potential site	Visit site	Logistics Survey equipments
Week	General Objective 4.0: Understand the procedure of Earth Dam construction					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6 - 10	4.1 Enumerate the considerations for dam axis selection 4.2 Describe Site clearing and preparation 4.3 Describe setting out of the dam axis. 4.4 Describe plant and equipment for earth dam construction 4.5 Describe compaction equipment and techniques. 4.6 Describe optimum compaction	<ul style="list-style-type: none"> ▪ Lectures ▪ Illustrate site selection and setting out ▪ Illustrate compaction procedure 	Teaching tools. Triaxial machine	▪	▪	▪
Week	General Objective 5.0: Describe finishing works					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11- 13	5.1 Describe inspection requirements 5.2 Enumerate maintenance procedures	<ul style="list-style-type: none"> ▪ Lectures ▪ Illustrate maintenance procedure 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard,	▪	▪	▪

			PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
General Objective 6.0 Understand concrete reservoir (ground and overhead)						
1.0 Explain the setting out of site for ground and overhead reservoir 2.0 Explain the construction process of concrete reservoir 3.0 Explain quality control in the construction of concrete reservoir	Illustrate with good examples activities in 1.0 to 3.0. <input type="checkbox"/> Assess the student	1.0 Engineerin g drawing 2.0 Measuring tapes 3.0 Work programme		▪	▪	▪
General Objective 7.0 Understand intake structure (head works)						
1.0 Explain the construction process of intake structure 2.0 Explain quality control in the construction of intake structure	Illustrate with good examples activities in 1.0 to 2.0. <input type="checkbox"/> Assess the student	1.0 Engineerin g drawing 2.0 Measuring tapes 3.0 Work programme		▪	▪	▪
General Objective 8.0 Understand water treatment plant						
1.0 Understand the principles of the construction of water treatment plant 2.0 Explain the procedure for the construction of water treatment units 3.0 Explain the procedure for installing water treatment plant components	<ul style="list-style-type: none"> ▪ Lectures ▪ Illustrate the procedure for the construction of water treatment plant 	1.0 Engineerin g drawing 2.0 Measuring tapes 3.0 Work programme		▪	▪	▪
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.						

Department/Programme: ND Water Resources Engineering Technology	Course Code: MTH 122	Contact Hours: 2 – 0 - 0
Subject/Course: Trigonometry and Analytical Geometry		Theory: 2 hours/week
Year: ND II Semester: 1st	Pre-requisite: MTH 112	Practical: 0 hours/week

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**

PROGRAMME:						
COURSE: TRIGONOMETRY AND ANALYTICAL GEOMETRY				COURSE CODE: MTH 122		CONTACT HOUR: 2-0-0
Course Specification:		Theoretical Content: 2 hrs			Practical Content: 0hrs	
General Objective 1.0: Understand the manipulation of trigonometric equations						
Week	General Objective 1.0: Understand the manipulation of trigonometric equations					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1-3	1.1 Convert sums and differences of trigonometric ratios to products: $\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$ 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. If a man walks 3km due N, and the 3km N.52° W. How far is the of his starting point? What is his bearing from his original position? 1.6 Derive half angle formulae for sin, cos and tan. 1.7 Define inverse circular function.	<input type="checkbox"/> Illustrate with good examples activities in 1.1 to 1.10 and ask the students to solve problems on them. <input type="checkbox"/> Assess the student	<input type="checkbox"/> Recommended textbooks, lecture notes, Whiteboard, Marker, etc	▪	▪	▪

	<p>1.8 Explain inverse circular functions graphically.</p> <p>1.9 Solve problems involving 1.8 and e.g.:- Draw the graph of $1/(\cos 2\theta)$ taking values from 0° to 90° inclusive.</p> <p>1.10 Apply the concepts in 1.8 above to three dimensional problems.</p>					
Week	General Objective 2.0: Understand the concept of mensuration and its application to engineering problems					
4-5	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>2.1 Explain circular measure</p> <p>2.2 State the relation between radians and degrees</p> <p>2.3 Prove the formulae for arc length and area of a sector.</p> <p>2.4 Identify segment and chord of a circle. Determine the area of a segment and the chord of length of a given circle. Calculate the surface areas and volumes of simple shapes such as cylinder, sphere and cone. E.g. A solid sphere has radius 8cm. Calculate its volume.</p> <p>2.7 Determine the areas and volumes of irregular shapes applying Simpsons rule.</p> <p>2.8 Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.</p>	<p>Illustrate with good examples activities in 2.1 to 2.8 and ask the students to solve problems on them.</p> <p>□ Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪

	<p>3.15 Solve examples of 3.11 to 3.14 above.</p> <p>3.16 Find the angle (Q) between two lines whose slopes, (m_1, and m_2) are Known: $Q = \tan^{-1} \frac{m_2 - m_1}{1 + m_1 m_2}$</p> <p>3.17 Determine the conditions for two lines to be parallel and to be perpendicular.</p> <p>3.18 Derive the expression for the perpendicular distance from a point to a line.</p> <p>3.19 Draw a circle.</p> <p>3.20 Derive the equation of a circle with center at the origin and radius r.</p> <p>3.21 Derive the equation of a circle with center outside the origin.</p> <p>3.22 State general equation of a circle.</p> <p>3.23 Determine the coordinates of the center of a circle from a given equation of a circle.</p> <p>3.24 Draw orthogonal circles</p> <p>3.25 Find the equations of the tangent and the normal at a point circle</p> <p>3.26 List illustrative examples of each of 3.20 to 3.25 above</p>	<p>in 3.21 to 3.26 and ask the students to solve problems on them</p>				
Week	General Objective 4.0: Know the different forms of conics such as ellipse, parabola and hyperbola					
12-14	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	<p>4.1 Define the Parabola</p> <p>4.2 Derive the standard equation of a Parabola $y^2 = 4ax$</p> <p>4.3 State the properties of the parabola</p> <p>4.4 Define the focal chord, axis and latus rectum of the parabola</p> <p>4.5 Determine the equation of the tangent and normal from a given point to the parabola.</p> <p>4.6 Solve problems on parabola e.g. Write down the equation of the parabola and</p>	<p>Illustrate with good examples activities in 4.1 to 4.19 and ask the students to solve problems on them.</p> <p>□ Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>▪</p>	<p>▪</p>	<p>▪</p>

	<p>state its vertex if the focus B is (2,0) and the direct $x = -2$.</p> <p>4.7 Define an ellipse</p> <p>4.8 Derive the equation of an ellipse $x^2/a^2 + y^2/b^2 = 1$</p> <p>4.9 State the properties of the ellipse</p> <p>4.10 Determine the equation of the tangent and the normal to an ellipse from a given point.</p> <p>4.11 Define focal chord and axes of ellipse.</p> <p>4.12 Solve problems on ellipses e.g. Find the length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$</p> <p>4.13 Define the Hyperbola</p> <p>4.14 Derive the equation of the Hyperbola</p> <p>4.15 Identify the properties of the Hyperbola.</p> <p>4.16 Define asymptotes, chord, tangent and normal to a hyperbola.</p> <p>4.17 Solve problems on hyperbola e.g. Find the foci and directrices for hyperbola: $x^2/16 - y^2/9 = 1$</p> <p>4.18 Explain rectangular hyperbola</p> <p>4.19 Determine tangent and normal to the rectangular hyperbola.</p>				
<p>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.</p>					

Department/Programme: ND Water Resources Engineering Technology	Course Code: EEd 216	Contact Hours: 1 – 0 - 2
Subject/Course: Practice of Entrepreneurship		Theory: 1 hours/week
Year: ND II Semester: 1st	Pre-requisite:	Practical: 2 hours/week

General Objectives:

On completion of the course, the student should:

- 1. Know techniques for generating business ideas and the process of identifying and assessing business opportunities**
- 2. Know how to evaluate a business idea for developing an enterprise**
- 3. Know methods of product/service selection**
- 4. Understand the process and procedure for starting an Enterprise**
- 5. Know the operational techniques in managing an Enterprise**
- 6. Understand the various existing industries and support agencies in Nigeria**
- 7. Appreciate the role of commercial and development banks in small and medium scale industries development**
- 8. Understand the role of personal savings and portfolio investment in National Economic Development**

Course:		Code: EEd 216		Credit Hour: 1 – 0 - 2		
		Pre-requisite: Intro to Entrepreneurship		Theoretical: 1 hours/week - %		
Semester: Third				Practical : 2 hours/week - %		
Theoretical Content				Practical Content		
General Objective 1: Know techniques for generating business ideas and the process of identifying and assessing business opportunities						
Week	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
1-2	1.1 Define business opportunity. 1.2 State the process of Exploring opportunities. 1.3 Identify business opportunities (SWOT Analysis) 1.4 State the process of conducting a market survey in order to establish demand/supply gap. 1.5 State the process of business idea generation.	I. Explain business opportunities and process of exploring them. II. Explain the process of product/service selection. III. Explain SWOT Analysis and how to identify business opportunities. IV. Explain the process of conducting market survey and selecting a viable business venture. V. Explain the process of business idea generation.	Text Books, Journals.	Identify business opportunities using SWOT Analysis. Conduct market survey and select the most viable business venture. Set up a small business enterprise	Guide students to identify business opportunities using SWOT Analysis Guide students to conduct market survey to enable them select the most viable business venture. Demonstrate using appropriate application package, product selection, product tracking, order tracking etc. Set up student groups with the task of setting up a small business enterprise. Invite a successful entrepreneur to give a talk. Make the student/group	Computer Text Books, Use of internet and relevant video clips. Guest speakers from successful businesses.

					generate his/their viable business idea which would further be subjected to feasible business plan.	
Theoretical Content				Practical Content		
General Objective 2: Know how to evaluate a business idea for developing an enterprise						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
3	<p>2.1 Define the concept of business plan.</p> <p>2.2 Explain the process of preparing preliminary project proposal.</p> <p>2.3 Explain the process of preparing a detailed business plan.</p> <p>2.4 Conduct a model business plan on a selected venture.</p>	<p>I. Explain a business idea.</p> <p>II. Explain the concept of business plan and project proposal.</p> <p>III. Relate business idea to business plan and project proposal.</p> <p>IV. Describe the steps in preparing a model business plan.</p>	Textbooks. Journey Projector (mm)	<p>Prepare a preliminary project proposal.</p> <p>Students groups to set up a small business enterprise with an initial capital of N10,000 at least.</p> <p>Conduct a modest business plan on a selected venture. Present the plan to a panel of successful entrepreneur for assessment.</p> <p>Explore Internet for company profile, product catalogue, product information, URL management.</p>	<p>Guide students in preparing a preliminary project proposal.</p> <p>Using the ongoing business project guide students to complete a business plan and present it to a panel of successful entrepreneurs, the plan should consider sale forecast, time sheet analysis, employee tracking, loan amortization etc.</p> <p>Explore Internet for company profile, product catalogue, product information, URL management.</p> <p>The written business plan should be assessed as part of continuous</p>	Computer complete with accessories and D base, Internet connection. Textbooks.

				Conduct a model business plan on a selected venture.	assessment	
Theoretical Content				Practical Content		
General Objective 3: Know methods of product/service selection						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
4-5	<p>3.1 Define product /service.</p> <p>3.2 Explain the nature and characteristics of product/service.</p> <p>3.3 Explain product selection criteria.</p> <p>3.4 Identify key factors associated with product selection.</p> <ul style="list-style-type: none"> - Infrastructure - Technology - Availability of raw material. - Government Policy/Regulation -Legal aspects of business. <p>3.5 Explain venture idea generation.</p> <p>3.6 Explain the steps involved in preliminary screening.</p> <p>3.9 Explain the different</p>	<p>I. Explain product selection, criteria and factors associated with selection.</p> <p>II. Explain venture idea generation.</p> <p>III. Explain steps involved in preliminary screening.</p> <p>IV. Explain steps in preparing pre-feasibility study.</p> <p>V. Explain the adequacy of infrastructural facilities, relevant technology and</p>	<p>Text Books</p> <p>Journals</p> <p>Publications.</p> <p>Projector (mm)</p>	<p>Analyze a given case in product selection.</p> <p>Select a product Prepare a feasibility report on a modern business and evaluate the viability, methodology and CBA. (Cost Benefit Analysis)</p> <p>Generate venture idea on selected exportable product obtained from the web.</p> <p>Write a report on their visit.</p>	<p>Guide students to analyze a case in product selection.</p> <p>Invite an Entrepreneur to speak on venture idea generation and product selection</p> <p>Guide students to prepare feasibility studies on a model institution based business and evaluate the viability, methodology and Cost Benefit Analysis (CBA.)</p> <p>Guide students to use web based information to generate venture idea on an exportable product.</p> <p>Organize visit to a small business outfit to understudy</p>	

	<p>steps in preparing pre-feasibility study.</p> <p>3.10 Evaluate adequacy of infrastructural facilities for product selection.</p> <p>3.10 Identify the relevant technology available for the selected product.</p> <p>3.11 Evaluate sources and adequacy of raw materials for the selected product.</p> <p>3.12 Explain effects of government policy and regulations on the selected product.</p> <p>3.13 Identify legal aspects of business in product selection.</p>	<p>adequacy of raw materials for the selected product.</p> <p>VI. Explain effects of government policy and regulation as well as legal aspects of business on the selected product</p>			<p>infrastructural facilities, available technology, sources and adequacy of raw materials, effect of government policy and regulation and legal aspects of the business.</p>	
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Theoretical Content				Practical Content		
General Objective 4: Understand the process and procedure for starting an Enterprise						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
6-7	<p>4.1 Out line the main features of the Companies and Allied Matters Act (CAMA) 1990 and the subsequent amendments.</p> <p>4.2 Explain the functions of the Corporate Affairs Commission (CAC) under the Companies and Allied Matters Act 1990.</p> <p>4.3 Explain the legal structure of business.</p> <p>4.4 State factors to consider in naming a business.</p> <p>4.5 Explain the procedure and requirements for registration of a business name.</p>	<p>I. Explain the main features of the CAMA with special reference to provisions relating to registration and incorporation of business.</p> <p>II. Explain the functions of CAC.</p> <p>III. Explain the different legal forms of business.</p> <p>IV. Explain reasons for and factors in naming a business.</p>	Textbooks CAMA Articles and Memo of Association Certificate of Incorporation.	<p>Prepare Memorandum and articles of Association for a hypothetical company.</p> <p>Identify documents required for incorporation.</p>	<p>Guide students to prepare Memorandum and Articles of Association of a hypothetical company.</p> <p>Show students necessary Incorporation documents.</p> <p>Visit CAC office nearest to you to familiarize with its operation.</p>	Text books CAMA Internet (CAC Website)

	<p>4.6 Explain the procedure and requirements for incorporating a business.</p> <p>4.7 Explain the reasons for the existence of registered business names and companies.</p> <p>4.8 Identify various agencies responsible for issuance of licenses and permits.</p>	<p>V. Explain Memorandum and Articles of Association and the procedure for incorporation of companies in Nigeria.</p> <p>VI. Explain licenses and permits and their issuing Agencies.</p>		<p>Register a business name.</p>	<p>Guide students to register a hypothetical business name with the nearest CAC</p>	
Theoretical Content				Practical Content		
General Objective 5: Know the various operational techniques in managing an Enterprise						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
8-9	<p>5.1 Define management and a manager</p> <p>5.2 Explain the functions of management and a manager</p> <p>5.3 Explain management structure for an enterprise.</p> <p>5.4 Explain the communication process in</p>	<p>I. Explain the functions, techniques and skills of management.</p> <p>II. Draw a management structure to suit the viable project</p>	<p>Text Books Specimen of financial records. Cardboard Marker.</p> <p>Organogram</p>	<p>Draw appropriate organogram for a small scale enterprise.</p> <p>Identify communication process in the management of an enterprise.</p>	<p>Guide student to draw an organo gram to suit the selected business venture.</p> <p>Demonstrate the techniques and skills of communication process in the management of the selected business venture, using</p>	<p>Text books sample Record books Projector (MM) organogram</p>

	<p>the management of an enterprise.</p> <p>5.5 Explain the techniques and skills of:</p> <ol style="list-style-type: none"> i. Planning ii. Organizing iii. Staffing iv. Leading v. Controlling <p>5.6 Explain the basic techniques of marketing, production and financial management in an enterprise.</p> <p>5.7 Explain the principles of record keeping, auditing and taxation.</p>	<p>selected by students</p> <p>III. Explain the techniques of the functional areas of management.</p> <p>IV. Explain principles of record keeping, auditing and taxation.</p>		<p>Explain the functional areas of business management, planning, organizing, etc.</p>	<p>computer networking of not less than 3 computers.</p> <p>Demonstrate, using appropriate application packages, techniques and skills of:</p> <p>Business planning Business positioning Business scheduling Staffing and staff tracking, etc explaining their importance to sustainable business venture.</p>	
Theoretical Content				Practical Content		
General Objective 6: Know the various existing industries and support agencies in Nigeria						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
	<p>6.1 Explain various industry/support agencies.</p> <p>6.2 Explain the types, and sources of materials used in both manufacturing and service Industries.</p>	<p>I. Explain Industry, types and support agencies.</p> <p>II. Explain the nature, types and sources of materials,</p>	<p>Textbooks, Journals, CD's/Film VCR</p>	<p>Identify types and sources of plants and machinery used in small scale industries, nature and type of material inputs and information about</p>	<p>Guide students to visit websites to identify types and sources of machinery and plants, material inputs for small scale industries, information and assistance for finance</p>	<p>Computer and accessories with Internet connection. Textbooks and</p>

10-11	<p>6.3 Explain the types and sources of plants and machinery used in small scale Industries.</p> <p>6.4 Explain the various information and assistance for vital areas like finance, registration, project selection, training, marketing, research, quality control, raw materials, patent information etc.</p> <p>6.5 Explain environmental factors associated with Industrial and economic development in Nigeria.</p>	<p>machineries and information in enterprises.</p>		<p>market and financial assistance.</p> <p>Prepare a report and share experience.</p>	<p>market etc.</p> <p>Form groups and assign them out of class. Visit/experience in selected enterprise.</p> <p>Groups to share experiences on the visit.</p>	<p>journals.</p>
Theoretical Content				Practical Content		
General Objective 7: Appreciate the role of commercial and development banks in small and medium scale industries development						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
12-13	<p>7.1 Identify financial institutions involved in entrepreneurial development.</p> <p>7.2 Explain the role of Banks and financial institutions in the creation and development of enterprises.</p> <p>7.3 Explain government policy on financing small</p>	<p>I. Explain the role of financial institutions in entrepreneurial development.</p> <p>II. Explain the role of commercial and development Banks in the promotion and development of SMEs.</p> <p>III. Examine government policies</p>	<p>Textbooks, Journals and other publications.</p>	<p>Identify sources of finance to SME's and how to access their funds</p>	<p>Guide students to identify sources of finance for SME's.</p> <p>Invite a Finance Expert to give a talk.</p> <p>Guide students to develop healthy</p>	<p>Projector (16 mm) Computer Internet.</p>

	and medium enterprises. 7.4 Explain the role of microfinance (Formal and Informal) in financing enterprise. 7.5 Explain the role of capital markets in Financing enterprise.	on financing SMEs. IV. List support agencies for SMEs in Nigeria-NEPC, IDCs, BOI, and NACR DB etc. V. Explain government policy on financing SMEs.			banking culture: <ul style="list-style-type: none"> • Good customer relations • Regular lodgements • Bank reconciliation. 	
General Objective 8: Understand the role of personal savings and portfolio investment in National Economic Development						
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
14-15	8.1 Define the following; Income, expenditure and savings 8.2 Explain the role of savings in starting and sustaining businesses 8.3 List the benefits of interest. 8.4. Explain personal Financial Planning and management. 8.5 Explain shopping habits 8.6 Explain portfolio investment-shares, bonds, debentures.	I. Explain savings II. Explain how savings are channelled into productive ventures. III. Explain the benefits of interest. IV. Explain the role of budgeting in personal economics V. Describe shopping habits VI. Analyze portfolio investment. VII. Explain thrift societies and how they operate.	Textbooks, Journals and other publications.	Calculate interest rates. Develop personal budget for one month. Create a spreadsheet for a budget Learn to save and invest in portfolio.	Show various methods of computing interest Guide students to develop a personal budget for one month Guide students to create a spreadsheet for a budget Invite a stock broker to give a talk.	Textbooks, journals and other publications, computer.
ASSESSMENT CRITERIA						
EXAMINATION	60%	CONTINUOUS ASSESSMENT	40%	Other (Examination/ project/ portfolio) %		

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 209		Contact Hours: 2 – 0 - 0
	Subject/Course: Introduction to Technical Report Writing			Theoretical: 2 hours/week
	Year: II Semester: 1st	Pre-requisite: -		Practical: 0 hours /week

General Objectives:

1. **Understand the Content of a Technical Report**
2. **Understand the methodology and sequence of writing Technical Report**
3. **Understand the information that is required in Technical Report Writing**
4. **Know how to analyze data.**
5. **Know how to present information/data**

	Course: Introduction to Technical Report Writing	Course Code: WRE 209			Contact Hours: 2-0-0	
				Theoretical: 2 hours/week		
	Year: II Semester: 1st	Pre-requisite: -			Practical: 0 hours /week	
	Theoretical Content			Practical Content		
General Objective 1: Understand the Content of a Technical Report						
Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
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.	<ul style="list-style-type: none"> ▪ Discuss the concept of technical report ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 	Whiteboard/ White marker Board /Projector	▪	▪	▪
General Objective 2: Understand the methodology and sequence of writing technical report						
3 – 5	2.1 Discuss the methods of determining the following in technical reports; <ul style="list-style-type: none"> a. Topic and title. b. Justification of title. c. Abstract or synopsis of the report. d. Aim and objectives of the report. . e. Scope and limitation of project. f. Classification of data g. Data analysis (Graphical method, tabular method 	<ul style="list-style-type: none"> ▪ List the methodology and sequence of writing technical report. ▪ Explain the methods and sequence of writing technical report. ▪ Use questions and answer technique ▪ Give examples 	Whiteboard/ White marker Board/ Projector	▪	▪	▪

	descriptive method). h. Presentation of data (use of appendices).	<ul style="list-style-type: none"> ▪ Give assignments 				
General Objective 3: Understand the information that is required in technical report writing						
6 – 9	3.1 Explain the various types of information that would be required in reports 3.2 Explain the factors that influence solutions. 3.3 Select criteria required in case studies. 3.4 Determine critical analysis of case studies. 3.5 Produce summary. 3.6 Make propositions (Author’s Propositions). 3.7 Develop conclusion to a technical report. 3.8 Write a bibliography in standard format. 3.9 Explain terms of reference in report. 3.10 Explain the difference between facts and opinions. 3.11 Explain how facts and opinions may be distinguished in writing report. 3.12 Write reports on selected technical matters. 3.13 Rewrite the abstract.	<ul style="list-style-type: none"> ▪ Discuss the various types of information required for writing technical report. ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 	Whiteboard/ White marker Board/ Projector	▪	▪	▪
General Objective 4: Know how to Analyze data.						
10 - 12	4.1 Mention main sources of data. 4.2 Discuss techniques of data collection: <ul style="list-style-type: none"> • Laboratory. 	<ul style="list-style-type: none"> ▪ Guide student on techniques involved in sourcing data 	Whiteboard/ White marker Board/ Projector	▪	▪	▪

	<ul style="list-style-type: none"> • Field survey/measurement. • Questionnaire. • Oral interviews. 	<ul style="list-style-type: none"> ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 				
General Objective 5: Know how to present information/data						
13 - 15	<p>5.1 Explain how to present data in a manner suitable for writing technical report in the following form: Tables, Graphs, Charts, bars.</p> <p>5.2 Input information into computer.</p> <p>5.3 Print out results.</p>	<ul style="list-style-type: none"> ▪ Guide student on techniques involved in presenting information/ data ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments 	Whiteboard/ White marker Board/ Projector Computers. Softwares.	▪	▪	▪
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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: COM 113		Contact Hours: 2 – 0 - 2
	Subject/Course: Introduction to Computer Programming			Theoretical: 2 hours/week
	Year: II	Semester: 1st	Pre-requisite: ICT 119	Practical: 2 hours /week

General Objectives:

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

- 1.0 Understand features of a good program.**
- 2.0 To understand the concept of Algorithms and flowcharting.**
- 3.0 Understand the principles of designing algorithms for common programming problem.**
- 4.0 Understand General modular program design principles.**
- 5.0 Understand the procedure in solving programming problems.**
- 6.0 Understand the various levels of programming language.**
- 7.0 Understand the concept of debugging and maintaining program.**
- 8.0 To understand good programming practices.**

	Course: Introduction to Computer Programming	Course Code: COM 113		Contact Hours: 2 – 0 - 2		
				Theoretical: 2 hours/week		
	Year: II	Semester: 1st	Pre-requisite: ICT 119		Practical: 2 hours /week	
	Theoretical Content			Practical Content		
	General Objective 1: understand features of a good program.					
Week/s	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1	Be able to: <ul style="list-style-type: none"> Define a program Explain features of good program (Accuracy, maintenance, efficiency, reliability, etc). 	<ul style="list-style-type: none"> Define and explain program with concrete illustration. Explain in details the various feature of a good program. 	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.	To be able to view some programming languages in computer	To assist student view some programming languages in computer	PCs loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory
Week/s	General Objective 2: Understand the concept of Algorithms and flowcharting					
2-4	Be able to: <ul style="list-style-type: none"> Define algorithm on a general basis. Explain features of an algorithms (e.g. please, effective, finite) Describe the methods of algorithm representation of English language, flowchart, pseudo code, decision table, 	<ul style="list-style-type: none"> Describe the concept of algorithm with its features. Give concrete examples 	PC loaded with traditional languages such as Basic, Cobol, Fortran etc	To be able to draw flowcharts for simple programming problems.	To assist students in drawing flowcharts for simple programming problems.	PC loaded with traditional languages such as Basic, Cobol, Fortran etc

	<p>data flow diagram (DFO) etc.</p> <ul style="list-style-type: none"> Describe main ANSI flowcharts as describe algorithms. Draw flowcharts to implement some simple programming tasks 	<p>algorithms.</p> <ul style="list-style-type: none"> Teach the various methods of presenting algorithm with examples. 	<p>and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.</p>			<p>and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory</p>
Week/s	General Objective ; 3: Understand the principles of designing algorithms for common programming problem					
5-6	<p>Be able to:</p> <ul style="list-style-type: none"> Design algorithm for problems involving. -Strictly sequence control structure -Selection control structure -Iteration control structure 	<ul style="list-style-type: none"> Show the Structure and how develop simple programming problem involving each of basic control structure. Give class exercise, assignments to strict to practice on. Correct the algorithm developed by the students. 	<p>PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.</p>	<p>To be able to write simple programs using different control structure</p>	<p>To assist student in writing simple programs using different control structure</p>	<p>PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory</p>
Week/s	General Objective 4: Understand general modular program design principles.					
7-8	<p>Be able to:</p> <ul style="list-style-type: none"> Explain modular programming concept. Explain top-down design technique. Illustrate program design with program structure charts, hierarchical Network, Hierarchical. Demonstrate each of the 4.1 –43 above. 	<ul style="list-style-type: none"> Discuss the concept and advantage of modular programming Discuss and illustrate with 	<p>PC loaded with traditional languages such as Basic, Cobol,</p>	<p>To be able to design a program using top-down technique</p>	<p>To assist student to design a program using top-down technique</p>	<p>PC loaded with traditional languages such as Basic, Cobol,</p>

		like programs e.g. payroll, student records, etc. • Top-down design principles.	Fortran etc and OO languages Such as VB, OO- COBOL, OO-Pascal and connected to OHP.			Fortran etc and OO languages Such as VB, OO- COBOL, OO-Pascal in a networked laboratory
Week/s	General Objective 5: Understand the procedure in solving a programming problems					
9	Be able to: <ul style="list-style-type: none"> Identify the problem and confirm it solvable. Design algorithm for the chosen method of solution with flowcharts or pseudo codes. Code the algorithm by using a suitable programming language. Test run the program on the computer. 	<ul style="list-style-type: none"> Discuss the stages involved developing program. Demonstrate the stages above with real life program possible. 	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.	To be able to code a simple algorithm using any suitable language.	To assist student in coding a simple algorithm using any suitable language.	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory
Week/s	General Objective 6: 0 Understand the various levels of programming languages					
10-11	Be able to: <ul style="list-style-type: none"> Explain machine language, low-level language and high level languages Give examples of the languages stated above. Explain the distinguishing features of languages in 6.1. 	<ul style="list-style-type: none"> Discuss the feature of machine language, low level language, and high level language. 	PC loaded with traditional languages such as Basic, Cobol,	To be able to code a very simple high level language and translate it to assembly language.	To assist student code a very simple high level language and	PC loaded with traditional languages such as Basic, Cobol,

	<ul style="list-style-type: none"> Distinguish between system comments and program statements. 	Highlight the advantages and disadvantage of level of programming layout	Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.		translate it to assembly language.	Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory
Week/s	General Objective 70 Understand the concept of debugging and maintaining program:					
12	Be able to: <ul style="list-style-type: none"> Define debugging. Identify sources of bugs in a program Explain syntax, run-time and logical errors. Identify techniques of locating bugs in a program Explain program maintenance. Distinguish between debugging and maintaining a program 	<ul style="list-style-type: none"> Discuss various methods of debugging, aids. High light classes Differentiate between debugging and maintenance. Discuss sources of bugs in program 	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.	To be able to create a simple bug in a simple program and correct it	T assist student create a simple bug in a simple program and correct it	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory
General Objective 8: To understand good programming practices						
13-14	Be able to: <ul style="list-style-type: none"> Employ structured approach to both flowcharting and program development. Employ program documents technique HIPS, data flow diagram, pseudo-cal. Explain graphic user interface, GUI. Define interactive processing. 	<ul style="list-style-type: none"> Discuss structured approach to flowcharting and programmin g.. 	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO	To be able to write simple structured program	To assist student write simple structured program	PC loaded with traditional languages such as Basic, Cobol,

			languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.			Fortran etc and OO languages Such as VB, OO- COBOL, OO-Pascal in a networked laboratory
Week/s	General Objective 9: Understand the concept of object oriented programming.					
15	Ability to understand : <ul style="list-style-type: none"> • The concept of OO programming. • the features of OO programming. • the concept of properties, events, objects and classes. 	--Explain object oriented (OO) program. --State the features of OOP --Explain the concept of properties -- Know the obstacles to internet growth in Nigeria. --Discuss writes, methods, events, objects and classes. --List various objects oriented programming languages --State The advantages of OOP	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal and connected to OHP.	To be able to identify properties, events, objects and class in a running OOP	To assist students identify properties, events, objects and class in a running OOP	PC loaded with traditional languages such as Basic, Cobol, Fortran etc and OO languages Such as VB, OO-COBOL, OO-Pascal in a networked laboratory

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

Type of Assessment	Purpose and Nature of Assessment (COM 113)	Weighting (%)
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Examination	Final Examination (written) to assess knowledge and understanding	60
Test	At least 1 progress test for feedback.	20
Practical / Projects	To be assessed by the teacher	20
Total		100

Recommended Textbooks & References:

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 202		Contact Hours: 2 – 0 - 3
	Subject/Course: Introduction To Water Supply & Waste Water Technology			Theoretical: 2 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite:	Practical: 3 hours /week

GENERAL OBJECTIVES:

On completion the student is expected to be able to:

- 1.0 **Know how to estimate water demand**
- 2.0 **Know sources of water**
- 3.0 **Know the principles of intake design**
- 4.0 **Know the different types of pump and their selection**
- 5.0 **Understand the basic water treatment processes**
- 6.0 **Understand methods of storage and distribution of treated water**
- 7.0 **Know the general principles involved in rural water supply**
- 8.0 **Know the sources and characteristics of waste water.**
- 9.0 **Understand basic methods and processes of sewage treatment.**
- 10.0 **Know major sewer appurtenances**
- 11.0 **Understand the effects of pollution and the methods of control.**

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Introduction to Water Supply and Wastewater Technology		Course Code: WRE 202			Contact Hours: 2 – 0 - 3	
Course Specification: Theoretical Content: 2 hours				Practical Content: 3 hours		
Course Objectives: This course is designed to expose the students to the basic principles of water supply and wastewater technology						
Week	General Objective 1.0: Know methods of estimating water demand					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1	1.1 State various uses of water. 1.2 Explain the hourly, daily and seasonal variation. 1.3 Identify the factors affecting water consumption. 1.4 Describe various methods of population prediction such as Arithmetic and Geometric methods.	<ul style="list-style-type: none"> List the various uses of water State factors affecting water consumption (peak and low demand) Explain different methods of estimating population Learn solve calculation based problems on population estimation 	<ul style="list-style-type: none"> White board, marker, slides, charts and pictures 	<ul style="list-style-type: none"> Know how to estimate population using different methods Estimate household demand of drinking water for a family 	<ul style="list-style-type: none"> Lecture and solve problems involving Arithmetic and geometric method of predicting population. Lecturer to arrange for site visit to selected houses. Give assignments to students 	<ul style="list-style-type: none"> White board, marker, slides, charts and pictures Logistics and transport
Week	General Objective 2.0: Know sources of water					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	2.1 Identify the various sources of water	<ul style="list-style-type: none"> Explain the various sources 	White board, marker, slides,	<ul style="list-style-type: none"> Identify the various sources of water 	<ul style="list-style-type: none"> Technologist to 	<ul style="list-style-type: none"> Logistics and

2	(streams, lakes, Rain and underground). 2.2 Identify factors for source selection.	of water <ul style="list-style-type: none"> • Explain the water cycle • List the factors affecting sources of water 	charts and pictures	(streams, lakes, underground) in immediate environment	conduct reconnaissance survey of immediate environment	transport
Week	General Objective 3.0: Know the principles of intake design					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
	3.1 Explain different types of intakes 3.2 State principles of intake design	<ul style="list-style-type: none"> • Sketch various types of intakes • Show wet and dry intakes structures • Explain why one intake is chosen over the other 	<ul style="list-style-type: none"> • White board, marker, slides, charts and pictures 	<ul style="list-style-type: none"> • Identify various types of intakes at different water works 	<ul style="list-style-type: none"> • Arrange visits to intake works 	<ul style="list-style-type: none"> • Logistics and transport
Week	General Objective 4.0: Know the different types of pumps and their selections.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
3	4.1 Explain the need for pumping water 4.2 Describe different types of pumps 4.3 Recognize the criteria for pump selections. 4.4 Identify types of pumping stations. 4.5 Prepare a plan of a pumping station	<ul style="list-style-type: none"> • Explain the workings of different types of pumps • Discuss pump selection using various charts • Learn solve calculation based problems 	White board, marker, slides, charts and pictures	<ul style="list-style-type: none"> • Visit a pumping station in a treatment plant • Identify various types of pumps and basis of selection for use. • Draw a plan of a pumping station 	<ul style="list-style-type: none"> • Teacher to arrange visit to treatment plant 	<ul style="list-style-type: none"> • Logistics and transport
Week	General Objective 5.0: Understand the basic water treatment processes.					
	Specific Learning	Teachers	Resources	Specific Learning Outcome:	Teacher Activities	Resources

	Outcome:	Activities				
4-6	<p>5.1 Explain the desirable standards of water for domestic and other uses – WHO and other standards.</p> <p>5.2 Explain the reasons for establishing these standards.</p> <p>5.3 Describe surveillance and sampling techniques.</p> <p>5.4 Explain methods of water analysis.</p> <p>5.5 Recognize the effect of pollutants in water.</p> <p>5.6 Explain physico-chemical treatment methods.</p> <p>5.7 Define aeration, screening, sedimentation and filtration.</p> <p>5.8 Define coagulation and flocculation.</p> <p>5.9 Outline different types of filtration such as slow sand filters, rapid sand filters and pressure filters.</p> <p>5.10 Explain back washing operation</p> <p>5.11 Describe basic principles of disinfection.</p> <p>5.12 Describe different</p>	<ul style="list-style-type: none"> • Explain the WHO, NSDWQ standards for drinking water • Explain sampling techniques • Describe step by step treatment of water • Explain chlorination showing residual chlorine and breakpoint chlorination 	White board, marker, slides, charts and pictures	<ul style="list-style-type: none"> • Distinguish between all essential water treatment processes and components • Collect effluent water samples from the sedimentation, coagulation, filter and chlorination tank and perform experiments on the water samples for colour, odour, taste, turbidity, acidity, alkalinity, hardness heavy metals, nitrate, Total suspended solids, total dissolved solids, total solids. Submit reports for marking. • Perform coagulation experiments using the jar test apparatus, to establish optimum coagulant dosage on various raw water samples. Submit reports for marking. 	<ul style="list-style-type: none"> • Show step by step processes of drinking water treatment • Teacher to plan experiment visit to a treatment plant for sample collection. Technologist to guide students in performance of experiments under teacher's supervision • Mark and grade all reports 	<ul style="list-style-type: none"> • Treatment plant, jar test apparatus, pH meter, DPD tablet, burette, pipette, Atomic absorption spectrophotometer(AAS), spectrophotometer, filter paper, etc. • Logistics and transport

	<p>methods of disinfection and advantages of each method.</p> <p>5.13 Distinguish between disinfection and sterilization.</p> <p>5.14 Define 'Breakpoint Chlorination'.</p> <p>5.15 Describe different methods of removing chemicals such as Fe and MI compounds from water.</p> <p>5.16 Explain how to control taste and odour.</p>					
General Objective 6.0: Understand methods of storage and distribution of treated water						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers' Activities	Resources
7-8	<p>6.1 Describe the general layout of public water supply schemes.</p> <p>6.2 Explain the purpose of services/storage reservoirs.</p> <p>6.3 Name the types of water distribution system.</p> <p>6.4 Explain the need for water metering.</p> <p>6.5 Recognize problems associated with the types of distribution systems.</p> <p>6.6 Identify the types of pipe materials for water supply projects.</p>	<ul style="list-style-type: none"> • Explain the general principles of pipe layout in a public water schemes • Explain different types of distribution and there problems, advantages and disadvantages • Explain the functions of different appurtenances in a pipe 	<ul style="list-style-type: none"> • White board, marker, slides, charts and pictures 	<ul style="list-style-type: none"> • Draw water storage and distribution systems. • Carry out the construction of water distribution line. • Calculate simple head losses in pipe or in a pumping line. 	<ul style="list-style-type: none"> • Demonstrate connections to and from storage reservoirs 	<ul style="list-style-type: none"> • Pipes network, pipes connections, bends, etc., plumbers' toolbox • White board, marker, slides, charts and pictures

	<p>6.7 Describe different types of pipe beddings for laying of pipe.</p> <p>6.8 Describe basic pipe networks.</p> <p>6.9 Identify the types of joints, valves used and their functions.</p> <p>6.10 Explain the functions of fire hydrants, washout chambers, thrust block, etc.</p> <p>6.11 Calculate simple head losses in pipes.</p>	<p>network</p> <ul style="list-style-type: none"> • Use different methods to calculate head losses in pipes 				
General Objective 7.0: Know the general principles involved in rural water supply.						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
9	<p>7.1 Identify different sources of rural water supply.</p> <p>7.2 Describe the different types of wells and their constructions.</p> <p>7.3 Explain the treatment methods of rural water supplies.</p> <p>7.4 Draw rural water supply lines.</p>	<ul style="list-style-type: none"> • Explain various sources of rural water supply (lakes, well, borehole, spring, etc) • Explain treatment given to rural water supply (e.g. filtration, chlorinating well) 	<ul style="list-style-type: none"> • White board, marker, slides, charts and pictures 	<ul style="list-style-type: none"> • Visit sites where construction of wells and rural water supply lines is being carried out in your area of operation and submit report of site visit. • Draw a plan of rural water supply lines 	<ul style="list-style-type: none"> • Organize site visit to construction site • Grade site visit reports 	<ul style="list-style-type: none"> • Logistics for movement
General Objective 8.0 : Know the sources and characteristics of waste water						
	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	8.1 Identify the sources of waste water	Illustrate with good examples activities	Instructional Manual.	<ul style="list-style-type: none"> • Prepare plan and drawing of sewers and manholes. 	<ul style="list-style-type: none"> • Teacher should explain 	<ul style="list-style-type: none"> ▪ Drawing board,

10	8.2 Define sewer, sewage and sewerage. 8.3 Explain the characteristics and composition of sewage. 8.4 Differentiate between pollution and contamination.	in 8.1 to 8.4. □ Assess the student	Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.		important components expected in the diagram	drawing pen, pencil, eraser, scale rule, set squares, T-square, drawing sheet.
General Objective 9.0: Understand basic methods and processes of sewage treatment						
	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
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.	<ul style="list-style-type: none"> Lecture and explain with the aid of schematic diagram of the various treatment process 	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<ul style="list-style-type: none"> Draw the plan of a house drainage system and show wastewater from latrines, sinks, urinals, bathrooms and washbasins. Estimate household wastewater for a family Observe, draw and label a septic tank and a soakaway pit. Undertake site visits to water and wastewater treatment plants and write reports. Draw all the components of a sewage treatment plant 	<ul style="list-style-type: none"> Lecturer to arrange for site visit to selected sewage treatment plant. Give and grade assignments to students. 	<ul style="list-style-type: none"> Drawing board, drawing pen, pencil, eraser, scale rule, set squares, T-square, drawing sheet.

	<p>9.10 Identify the advantages and disadvantages of the conventional treatment processes.</p> <p>9.11 Explain flow diagram of the conventional treatment processes.</p> <p>9.12 Explain stabilization ponds and aerated lagoons; their advantages and disadvantages.</p> <p>9.13 Describe different types of on-site disposal systems such as septic tanks.</p> <p>9.14 Explain methods of disposing septic tank effluents such as by soakaways, sub-surface irrigation and drainfield.</p> <p>9.15 Define cesspool, aqua privy and pit latrines (including V.I.P latrine).</p> <p>Draw all components of sewage treatment.</p>					
General Objective 10.0: Know major sewer appurtenances						
	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	<p>10.1 Explain what appurtenances are</p> <p>10.2 Explain the following appurtenances</p>	<ul style="list-style-type: none"> • Lecture and sketch with the aid of schematic 	<p>Instructional Manual.</p> <p>Recommended textbooks, e-</p>	<ul style="list-style-type: none"> • Prepare the plan and drawing or sewers and manholes, Building sewers/house connections 	<ul style="list-style-type: none"> • Technologist should explain important 	<ul style="list-style-type: none"> ▪ Drawing board, drawing pen,

13-14	<p>i. Manhole</p> <p>ii. Building sewers/house connections and</p> <p>iii. Siphons</p> <p>10.3 Describe the different types of manholes</p> <p>10.4 List the functions and objectives of manholes</p> <p>10.5 Explain the following in relation to manholes:</p> <p>i. Spacing</p> <p>ii. frame and covers and</p> <p>iii. channel and benching</p> <p>10.6 Identify the types of materials suitable for house connections</p> <p>10.7 Describe the proper procedures for laying and making of house connections to sewers.</p> <p>10.8 Identify the following as waste water measuring devices</p> <p>i. Weirs</p> <p>ii. Parshall flume</p> <p>iii. venturi flume</p> <p>10.9 Explain the working of these devices</p> <p>10.10 Draw the devices</p>	<p>diagram the vertical sections of various appurtenances</p>	<p>books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	<p>and Siphons</p> <ul style="list-style-type: none"> Identify a house for study of drainage system 	<p>components expected in the diagram</p>	<p>pencil, eraser, scale rule, set squares, T-square, drawing sheet.</p>
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	enumerated above. Enumerate how to calculate discharges in the above devices.					
General Objective 11.0 Understand the effects of pollution and the methods of control.						
	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
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 streams. 11.6 Explain the stratification of lakes and reservoirs. 11.7 Describe the effect of stratification on water quality.	Illustrate with good examples activities in 11.1 to 11.7 <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> • Carryout experimental analyse on waste water samples for colour, odour, taste, turbidity, acidity, alkalinity, hardness and heavy metals, nitrate etc • Report experiments and submit to teacher 	<ul style="list-style-type: none"> ▪ Lecturer to arrange for site visit to selected wastewater treatment plants. Give assignments to students. ▪ Technologist to supply the equipment under the supervision of the lecturer. ▪ Technologist to demonstrate the processes of analysis and students to follow. ▪ Teacher to mark and grade experimental reports 	<ul style="list-style-type: none"> • Logistics and transport for industrial visit

<p>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.</p> <p>Competency: Students exposed to activities of water supply industry waste water collection and disposal.</p> <p>Assessment: Coursework 20%; Course tests 20%; Practicals 20% Examination 40%</p> <p>References:</p> <ol style="list-style-type: none">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, 1989.3. Venugopala Rao P. Textbook of Environmental Engineering Prentice Hall, India, 2004						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 204		Contact Hours: 2 – 1 - 1
	Subject/Course: Hygiene and Sanitation Promotion			Theoretical: 2 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite:	Practical: 1 hours /week

General Objectives : On completion the student is expected to be able to:

- 1.0 Understand Overview of hygiene and sanitation promotion**
- 2.0 Understand participatory problem identification and analysis techniques**
- 3.0 Know planning techniques of hygiene and sanitation promotion**
- 4.0 Understand Water, Sanitation and Hygiene (WASH) in school**
- 5.0 Know and develop an action plan for hygiene and sanitation promotion**
- 6.0 Know the importance and determine the extent of women participation in hygiene and sanitation protection**

PROGRAMME: NATIONAL DIPLOMA IN WATER RESOURCES ENGINEERING TECHNOLOGY						
Course: Hygiene and Sanitation Promotion		CODE: WRE 204			Contact Hours: 2 – 1 - 1	
Course Specification: Theoretical hours 2 hrs		Practical hours: 1 hour Tutorial hours: 1 hour				
Theoretical Content:				Practical Content:		
Week	General Objective 1.0: Understand Overview of Hygiene and Sanitation Promotion					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
1-2	1.7 State the forms of hygiene and sanitation promotion 1.8 Explain behavioural change in WASH 1.9 Explain the knowledge and skills required by hygiene and sanitation promotion Officer	<ul style="list-style-type: none"> • Facilitate students to give their understanding of hygiene, sanitation and promotion • Explain the key issues of hygiene and sanitation promotion • State the factors that influence behavioural change in community • Facilitate discussion on: <ol style="list-style-type: none"> a. how to change peoples' behaviour b. the three main factors for behaviour change using prepared 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers, masking tape etc.	<ul style="list-style-type: none"> • Form class focus groups and discuss <ol style="list-style-type: none"> a. how to change peoples' behaviour b. the three main factors for behaviour change using prepared appropriate questions c. kind of problems and challenges faced by hygiene and sanitation promotion Officer d. knowledge and skills required to solve the identified problems 	<ul style="list-style-type: none"> • Supervise class focus group discussions 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers, masking tape, structured questionnaire etc.

		<p>appropriate questions</p> <ul style="list-style-type: none"> Facilitate discussion on: <p>a. kind of problems and challenges faced by hygiene and sanitation promotion Officer</p> <p>b. knowledge and skills required to solve the identified problems</p>				
General Objective 2.0: Know Participatory Problem Identification and Analysis Techniques						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
3 – 7	<p>2.1 Explain participatory methods for identifying community condition and practices</p> <p>2.2 Explain participatory methods for problem analysis</p> <p>2.3 Describe planning</p>	<ul style="list-style-type: none"> Describe Community Mapping Describe Transect walk Explain common diseases in community and how community peoples' act in response Explain WASH 	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers, M& E chart, etc.</p>	<ul style="list-style-type: none"> Demonstrate participatory methods for identifying community condition and practices to: <p>a. Draw Community Map</p> <p>b. Conduct Transect walk</p> <p>c. Perform Role play (Nurse Omenka)</p> <ul style="list-style-type: none"> Demonstrate participatory methods for problem analysis to: <p>a. Sort drawings on posters into three pile (Three Pile Sorting): Good; In-between; Bad</p>	<ul style="list-style-type: none"> Facilitate activity to conduct: <p>a. Community Mapping</p> <p>i. observe minimum information that emerged</p> <p>b. Transect walk</p> <p>i. Review community map using information gathered from transect walk</p> <p>c. Role play (Nurse Omenka)</p> <p>i. Give role play guide</p>	<p>Pebbles, Marker, flip chart, markers, sticks, rural area, open space, local materials, observation checklist, pen, paper, posters showing</p>

	<p>solution</p> <p>2.4 Explain planning for monitoring and evaluation (M & E)</p>	<p>behaviours in community</p> <ul style="list-style-type: none"> • Explain main causes of faecal-oral diseases transmission • Explain blocking the transmission routes of faecal-oral diseases • Explain monitoring and evaluation in planning of WASH project • Facilitate discussion on preparing a M & E plan using sample of M & E chart 		<p>b. Draw faecal-oral transmission routes (F – Diagram) using posters</p> <ul style="list-style-type: none"> • Demonstrate planning solution to: <p>a. Create barriers for F – Diagram (Blocking the transmission routes)</p>	<ul style="list-style-type: none"> • Facilitate activity to sort posters of drawings according to: <p>a. Good practices;</p> <p>b. In-between practices;</p> <p>c. Bad practices</p> <ul style="list-style-type: none"> • Show possible faecal-oral transmission routes • Create barriers for F – Diagram using posters • Prepare field visits to communities • Students (in groups) to present field activities report in Strength, Weaknesses, Opportunity and Threats (SWOT) method 	<p>drawing of: Traditiona l healer; Nurse/Doc tor; a baby; a woman; a man Sets of three pile sorting drawings, flip chart, markers, masking tape, sets of posters showing drawing of: mouth, faeces, field, food, flies ,fluid (water) and fingers F – Diagram made from previous activity, Block the routes posters showing:</p>
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						Protected water source; Hand washing with soap/ash; Covered food; VIP latrine
General Objective 3.0: Understand Planning Techniques of Hygiene and Sanitation Promotion						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
8 – 10	<p>3.1 State steps for planning hygiene and sanitation promotion</p> <p>3.2 Explain how to identify key hygiene behaviours and targets</p> <p>3.3 Describe how to develop hygiene messages</p> <p>3.4 Explain how to communicate messages</p>	<ul style="list-style-type: none"> • State steps for planning hygiene and sanitation promotion • Prioritize hygiene issues • Facilitate how to develop hygiene messages for target audience • Facilitate discussion on Communication channels to deliver the hygiene messages 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> • Develop hygiene messages present on focus group basis • Discuss channels to deliver the hygiene messages 	<ul style="list-style-type: none"> • Supervise focus group discussions 	<ul style="list-style-type: none"> • Focus groups

General Objective 4.0: Understand Water Sanitation and Hygiene (WASH) in Schools						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
11 - 12	4.8 Define social mobilization for School WASH 4.9 Explain how to create awareness on menstruation and menstrual hygiene in schools 4.10 Describe how to develop baseline survey in schools 4.11 Explain the need for School Environmental Health Club (SEHC) 4.12 Explain how to develop	<ul style="list-style-type: none"> • Facilitate discussion to: <ol style="list-style-type: none"> a. define social mobilization as it relates to WASH for schools b. develop a plan of social mobilization in schools • Explain menstruation • State Dos and Don'ts of menstrual hygiene • Describe how to develop checklist for baseline survey in schools • State SEHC roles and responsibilities • Prepare a plan showing main actors, various activities and possible time frames for school WASH 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers etc.	<ul style="list-style-type: none"> • Present your developed plan of social mobilization in schools 	<ul style="list-style-type: none"> • Prepare field visit to schools 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers etc.

	school micro plan	programme				
General Objective 5.0: Know how to Develop an Action Plan for Hygiene and Sanitation Promotion						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
13	5.5 Explain the techniques for developing action plan for WASH implementation	<ul style="list-style-type: none"> Explain the concept of action plan for WASH implementation using sample formats 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, action plan sample format, etc.	<ul style="list-style-type: none"> Develop action plan for WASH implementation 	<ul style="list-style-type: none"> Facilitate development of the action plan 	Flip chart, markers,
General Objective 6.0: Know the importance and determine the extent of women participation in hygiene and sanitation protection						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
14	3.1 State the importance of involvement of women in hygiene and sanitation promotion in the household 3.2 State the	<ul style="list-style-type: none"> Facilitate focus group discussions on how to involve women in hygiene and sanitation promotion and protection 	<ul style="list-style-type: none"> Instructional Manual on focus group discussion 	<ul style="list-style-type: none"> Demonstrate participatory methods for identifying women groups and facilitate discussions on sanitation and hygiene issues 	<ul style="list-style-type: none"> Facilitate activity to conduct focus group discussions with women groups 	<ul style="list-style-type: none"> Paper, pen, primary health care workers, traditional health workers, women groups,

	importance of involvement of women in hygiene and sanitation protection in the household					
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ASSESSMENT: The continuous assessment tests, assignments and field visit reports 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.

SOME REFERENCE MATERIALS:

1. NWRI and UNICEF (2007) Trainers Participatory Hygiene and Sanitation Promotion Manual
2. NWRI and UNICEF (2007) Trainees Participatory Hygiene and Sanitation Promotion Manual
3. NWRI /RWSSC and JICA (2012) NWRI-RWSSC Course 8; Hygiene and Sanitation Promotion Manual
4. UNICEF and London School of Hygiene and Tropical Medicine (1999) A Manual on Hygiene Promotion
5. WHO (1998) PHAST Step by Step Guide- A Participatory Approach for the Control of Diarrhoeal Disease
6. WHO(2000) Operation and Maintenance of Rural Water Supply and Sanitation Systems

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: CEC 206		Contact Hours: 2 – 0 - 0
	Subject/Course: Introduction to Structural Design			
	Year: II	Semester: 2 nd	Pre-requisite:	Theory 2 hours Practical: 0 hours /week

General Objectives:

- 1.0 Understand the elastic theory, load factor and limit state methodology design in reinforced concrete elements.**
- 2.0 Know the various types of foundation.**
- 3.0 Understand simple structural steel design for tension, compression and flexure.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Introduction to Structural Design			Course Code: CEC 206		Contact Hours: 2 – 0 - 0	
Course Specification:			Theoretical Content: 2 hrs Tutorial: 1hr		Practical Content: 0 hrs	
Course Objectives: The students should design structural elements using codes of Practice.						
Week	General Objective 1.0: Understand the elastic, load factor and limit state methodology design in reinforced concrete elements.					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
1	1.1 Explain the evolution and application of codes of practice: NCP 1, 2, 3, CP3, CP114, CP110 and BS 8110 and EuroCode. 1.2 Define slab, beam, column and foundation. Explain T and L beams. 1.3 Explain factor of safety.	Illustrate with good examples activities in 1.1 to 1.3. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
2 - 3	1.4 Explain the concepts of elastic theory, load factor and Limit state design.	Illustrate with good examples activities in 1.4 to 1.6. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip	▪	▪	▪

			charts, etc.			
4	<p>1.5 Explain the different types of loading: dead live/superimposed and wind loads.</p> <p>1.6 Explain one way and 2 way slabs.</p>	<p>Illustrate with good examples activities in 1.5 to 1.6.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
5	<p>1.7 Draw a structural layout of a typical floor slab and use it as a basis for load estimation.</p> <p>1.8 Use the load estimated in 1.7 above to design a singly reinforced concrete slab and beam.</p>	<p>Illustrate with good examples activities in 1.7 to 1.8.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
6	<p>1.9 Define short and slender (long) column and axial loading</p>	<p>Illustrate with good examples activities in 1.9 to 1.9</p>	<p>Instructional Manual.</p> <p>Recommended textbooks, e-books, lecture</p>	▪	▪	▪

		<input type="checkbox"/> Assess the student	notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
Week	General Objective 2.0: Know the various types of foundation.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7	2.1 Describe various types of foundations: (strip, pad, raft, combined, pile). 2.2 Illustrate the principles governing the choice of foundations.	Illustrate with good examples activities in 2.1 to 2.2. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e- books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
8	2.3 Explain bearing capacity of soil and settlement of foundation. 2.4 Design spread or isolated footing for given load.	Illustrate with good examples activities in 2.3 to 2.4. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e- books, lecture notes, Whiteboard, PowerPoint	▪	▪	▪

			Projector, Screen, Magnetic Board, flip charts, etc.			
Week	General Objective 3.0: Understand simple structural steel design for tension, compression and flexure.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
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.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen,	▪	▪	▪

			Magnetic Board, flip charts, etc.			
11	3.6 Explain the principle of bolted/riveted and welded connections and their modes of failure: i.e. Shear, bearing and tearing.	<p>Illustrate with good examples activities in 3.6.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪
12	<p>3.7 Present fillet and butt welds.</p> <p>3.8 Present the strength of riveted and welded joints.</p>	<p>Illustrate with good examples activities in 3.7 to 3.8.</p> <p><input type="checkbox"/> Assess the student</p>	<p>Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.</p>	▪	▪	▪

13	3.9 Solve problems on the above topics.	Solve Problems in 3.9	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
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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.

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: CEC 212		Contact Hours: 2 – 0 - 3
	Subject/Course: Soil Mechanics I			Theoretical: 2 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite: WRE 108	Practical: 3 hours /week

General Objectives:

The course is to acquaint the students with the knowledge of the engineering properties of soil;

- 1.0 Understand the principle of compaction and its determination in the laboratory and on site.**
- 2.0 Know about California Bearing Ratio (CBR)**
- 3.0 Know Darcy’s Law and permeability in soil**
- 4.0 Understand Soil Stabilization**
- 5.0 Know shear strength of soils and application for the determination of bearing capacity**
- 6.0 Understand the earth pressure theories.**
- 7.0 Understand the compressibility and settlement of soils.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Soil Mechanics I			Course Code: CEC 212		Contact Hours: 2 – 0 - 3	
Course Specification: Theoretical Content: 2hrs					Practical Content: 3hrs	
Course Objectives 1.0:						
Week	General Objective 1.0: Understand the principle of compaction and its determination in the laboratory and on site.					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher 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	<ul style="list-style-type: none"> Detailed presentation of BS, Standard, BS Heavy, Modified and WASC Compactions. 	<ul style="list-style-type: none"> Whiteboard, Projector, Marker, writing tools, Standard Laboratory. 	a. Perform a compaction test in the laboratory to obtain the maximum Dry Density and Optimum moisture content.	<ul style="list-style-type: none"> Technologist prepares soil samples, equipment and monitor students during the practical. He should grade students' reports and submit to course lecturer. 	Compaction machine oven. Weighing balance, Graph sheets, pencil etc.
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.	<ul style="list-style-type: none"> Describe all field equipment, performances of output. 	Whiteboard, Projector, Marker, writing tools, Standard Laboratory			
3	1.9 Explain the site compaction procedure. 1.10 Illustrate how to achieve site compaction control. 1.11 Describe field density tests (sand replacement and density balloon methods). 1.12 Perform field compaction	<ul style="list-style-type: none"> Explain site compaction and field density tests 	Whiteboard, Projector, Marker, writing tools, Standard Laboratory	b. Conduct field density tests.	<ul style="list-style-type: none"> Technologist prepares soil samples, equipment and monitor students during the practical. He should grade 	Sand replacement equipment, Field balance, Moisture content cans

	tests.				students' reports and submit to course lecturer. Course lecturer is to supervise the above activities and collate the results of graded practicals.	
Week	General Objective 2.0: Know about California Bearing Ratio (CBR)					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4	2.1 Know California Bearing Ratio. 2.2 State its use in relation to design of road pavement.	<ul style="list-style-type: none"> Explain California Bearing Ratio; explain the use of CBR in design. 	Whiteboard, Projector, Marker, writing tools, Standard Laboratory	Conduct California Bearing Ratio (CBR) test.	<ul style="list-style-type: none"> Technologist prepares soil samples, equipment and monitor students during the practical. He should grade students' reports and submit to course lecturer. 	CBR mould, weighing balance, CBR machine, CBR chart, etc.
5	2.3 Design different layers of pavement using CBR values.	Design different layers of pavement using CBR values.	Whiteboard, Projector, Marker, writing tools, Standard Laboratory			
Week	General Objective 3.0 Know Darcy's Law and permeability in soil					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6	3.5 Understand the principles of hydrostatic and excess hydrostatic pressures, and hydraulic gradient. 3.6 Explain the principles of Darcy's Law 3.7 Describe the constant head and falling head permeability.. 3.8 Know constant and falling head	Explain the principles of hydrostatic and hydraulic gradient. Compute permeability using Darcy's law.	Whiteboard, Projector, Marker, writing tools, Standard Laboratory	Carry out permeability tests using constant and falling head permeameters.	Technologist prepares soil samples, equipment and monitor students during the practical. He should grade students reports and submit to course	<ul style="list-style-type: none"> Permeameters, stop watch, measuring cylinder

	permeability tests. 3.9 Describe one method of measuring the permeability of soil in the field.				lecturer	
Week	General Objective 4.0: Understand Soil Stabilization					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
7	4.1 Know the different types of soil stabilization, (mechanical cement, lime, bitumen, etc).	<ul style="list-style-type: none"> Explain the different types of soil stabilization. 	<ul style="list-style-type: none"> Whiteboard, Projector, writing tools, Laboratory. 			
Week	General Objective 5.0: Know shear strength of soils and application to determination of bearing capacity					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
8- 10	5.1 Write the Mohr-Coulomb shear strength equation defining all term in it. 5.2 Describe direct shear test. 5.3 Describe triaxial test (Drained and Undrained) 5.4 Know the unconfined compression test. 5.5 Evaluate shear parameters 5.6 Explain bearing capacities of soil. 5.7 Describe the applications of c and ϕ to the computation of bearing capacities.	<ul style="list-style-type: none"> Explain Mohr-Coulomb shear strength equation. 	Whiteboard, Projector, writing tools, Laboratory	Carry out direct shear and triaxial compression test to obtain (C and ϕ)	Technologist prepares soil samples, equipment and monitor students during the practical. He should grade students reports and submit to course lecturer	<ul style="list-style-type: none"> Direct shear box machine Triaxial machine,
	General Objective 6.0: Understand the earth pressure theories.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11- 13	6.1 Explain active and passive pressures and earth pressure. 6.2 Describe Rankine's earth pressure theory.	Explain active and passive pressures. Compute earth pressure using Rankine's and	Instructional Manual. Recommended textbooks, e-		Technologist prepares soil samples, equipment and monitor	<ul style="list-style-type: none"> Direct shear box machine Triaxial

	6.3 Describe Coulomb's earth pressure theory. 6.4 Evaluate earth pressure using 5.2 and 5.3.	Coulomb's equations	books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.		students during the practical. He should grade students reports and submit to course lecturer	machine,
General Objective 7.0: Understand the compressibility and settlement of soils.						
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
14	7.1 Know 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 .	Explain consolidation tests	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Demonstrate 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	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	Consolidation machine, weighing balance, moisture content cans, graph sheets, etc.
15	7.3 Determine the amount of total consolidation settlement of a foundation using the results of 6.2.	<ul style="list-style-type: none"> Perform calculations step by step. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
ASSESSMENT: The continuous assessment, tests and quiz 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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 206		Contact Hours: 2 – 0 - 1
	Subject/Course: Irrigation and Drainage			Theoretical: 2 hours/week
	Year: II	Semester: 2nd	Pre-requisite:	Practical: 1 hours /week

GENERAL OBJECTIVES:

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

- 1.0 Understand the concept of irrigation and drainage**
- 2.0 Know the water requirement of Crops.**
- 3.0 Understand surface and ground water as the major sources of irrigation water.**
- 4.0 Know irrigation structures and pumps.**
- 5.0 Know crop watering systems and requirements.**
- 6.0 Understand Irrigation Efficiency.**
- 7.0 Understand the methods and structures for drainage, flood and tide control.**

PROGRAMME: ND Water Resources Engineering Technology						
COURSE: Irrigation and Drainage			Course Code: WRE 206		Contact Hours: 2 – 0 - 1	
GOAL: This course is designed to enable the students understand the principles of irrigation and drainage of agricultural lands.						
COURSE SPECIFICATION:			Theoretical Content :2 Hours		Practical Contents: 1 hour	
General Objective : 1.0 Understand the concept of irrigation and drainage						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	1.1 Outline the basic principles associated with irrigation and drainage	<ul style="list-style-type: none"> Give the definitions and explain the relationships between irrigation and drainage 	<ul style="list-style-type: none"> Board, cardboard display, slides, Textbooks, internet 	▪	▪	▪
	1.2 State the problems associated with irrigation and drainage practices.	<ul style="list-style-type: none"> Give some of the likely problem associated with irrigation and drainage 	<ul style="list-style-type: none"> Board, cardboard display, slide of irrigation or drainage fields, Textbooks 	▪	▪	▪
General Objective: 2.0 Know the water requirements of crops.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
2	2.1 Describe the different forms of soil moisture e.g., gravitational water, available water, field capacity, wilting point	<ul style="list-style-type: none"> With drawings and simple practical demonstrate gravitational water, available water, field capacity, wilting point etc. 	<ul style="list-style-type: none"> Board, drawings, slides and pictures explaining classes of soil moisture. 	<ul style="list-style-type: none"> Measure soil moisture using appropriate equipment and tools 	<ul style="list-style-type: none"> Demonstrate methods of determining soil moisture in the field 	Soil moisture meter, Tensiometer

	2.2 Describe the concept of available water capacity of a soil.	<ul style="list-style-type: none"> Define field capacity. State formula for calculating it. Using some values carryout some calculations. 	Board, drawings, slides and pictures explaining ways of calculating water capacity of soil.	<ul style="list-style-type: none"> Calculate available water capacity of a soil. 	<ul style="list-style-type: none"> Demonstrate methods of determining soil AWC and supervise students to carry out the same processes 	Soil moisture meter, Tensiometer
3	2.3. State the problems, origins and methods of control of saline and alkaline soils.	<ul style="list-style-type: none"> Explain the meaning, causes and control of each 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Collect and analyse water samples for salinity and alkalinity 	Collect irrigation water and test for alkalinity. Oversee students in carrying out analysis	pH and EC meter and other lab apparatus.
4	2.4. Describe how to determine consumptive water use by different methods using meteorological data.	<ul style="list-style-type: none"> Explain the procedures of determining the consumptive use of water by different methods. 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Recognise how to determine consumption use of water using different methods. 	<ul style="list-style-type: none"> Demonstrate different methods of determining water consumption using different methods. 	Marker, magic board.
5	2.5 Describe how to determine the evapotranspiration of a given area using lysimeter.	<ul style="list-style-type: none"> Explain the lysimeter and how it is used. 	A detailed picture of the lysimeter	<ul style="list-style-type: none"> Draw picture of lysimeter. Mention the constructional features of the lysimeter and how to use them. 	<ul style="list-style-type: none"> Construct a local lysimeter and use it to estimate evapotranspiration. 	Local lysimeter, Boards, drawings, slides and pictures
General Objective: 3.0 Understand the uses of Surface and Ground water as the major sources of irrigation water.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
6	3.1. Identify the major sources of surface water and how it is stored	<ul style="list-style-type: none"> Explain the main sources of surface water and methods of collecting and 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Recognize the main sources of surface water in the immediate environment 	<ul style="list-style-type: none"> Arrange visits to surface water sources 	<ul style="list-style-type: none"> Logistics and transport

		storing for agricultural use				
7	3.2 Identify sources of ground water and the different forms in which it exists	<ul style="list-style-type: none"> Explain the various forms and nature in which ground water exists. 	Board, drawings, slides, pictures explaining various forms and nature of ground water.	<ul style="list-style-type: none"> Recognise the main features of water abstraction wells and their management for effective water supply 	<ul style="list-style-type: none"> Organise visit to borehole or well and explain how the well is managed to ensure effective water abstraction and supply 	<ul style="list-style-type: none"> Groundwater abstraction site
General Objective: 4.0 Know irrigation structures and pumps.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
8	4.1 Identify different types of irrigation pumps and their working principles 4.2 State the criteria for pump selection.	<ul style="list-style-type: none"> Explain suction/delivery heads. Explain relation between head and discharge Explain the criteria for the selection of pumps. 	Boards, drawings, slides and pictures Board, drawings, slides, pump selection manual.	<ul style="list-style-type: none"> Identify the different types of pump. Enumerate how to select pumps for specific situations 	<ul style="list-style-type: none"> Arrange a Visit to pump maintenance shop to identify different makes and models of pumps. Demonstrate how to select irrigation pumps for specific water supply situations using characteristics curve 	Pump selection manual and plumbing tools Board, drawings, slides, pump selection manual.
9	4.3 Outline the maintenance requirements of irrigation pumps.	<ul style="list-style-type: none"> Explain the methods of maintaining irrigation pumps. Explain Trouble shooting of pumps 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Carry out routine checks and services required of the irrigation pumps. 	<ul style="list-style-type: none"> Demonstrate routine checks and basic maintenance requirements of irrigation pumps. 	Pumps; maintenance schedules; Manuals; Tools.
General Objective: 5.0 Know Crop Watering System and requirements						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
10	5.1 State different water application methods in	<ul style="list-style-type: none"> Explain the different water application 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Recognise the main features and components of 	<ul style="list-style-type: none"> Visit irrigation fields with the students to identify 	Irrigation facilities.

	irrigation	methods and their suitability for different crops e.g surface irrigation sub-surface irrigation, sprinkler irrigation.		different irrigation systems.	the different water application methods.	
11	5.2 Outline the factors that determine when to irrigate and how much water to apply	<ul style="list-style-type: none"> List the factors and explain each. Explain the process of determining crop water requirement. 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> Determine irrigation requirements for different crops 	<ul style="list-style-type: none"> Using data from crop water requirements, soil retention capacity and others, explain procedures for schedule irrigation. 	Boards, drawings, slides and pictures
General Objective: 6.0 Understand Irrigation Efficiency						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
12	6.1 Describe the Concept of Irrigation Efficiency	<ul style="list-style-type: none"> Explain the concept of Irrigation Efficiency Define Irrigation efficiencies. 	Board, textbooks, internet and slides.	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪
	6.2 State Components of Project Irrigation Efficiency.	<ul style="list-style-type: none"> Explain the different Components of Project Irrigation Efficiency e.g. Water Conveyance Efficiency; Water 	Board, drawings, slides and pictures explaining ways of calculating Irrigation Efficiency.	<ul style="list-style-type: none"> Calculate the Irrigation Efficiencies using various formulae Determine irrigation efficiency in the field and submit report. 	<ul style="list-style-type: none"> Demonstrate methods of determining Irrigation Efficiencies in the field Grade submitted reports 	Weir Parshall flume

		Application Efficiency; Water Storage Efficiency; Water Distribution Efficiency and Water Use Efficiency.				
General Objective: 7.0 Understand methods and structures for drainage, flood and tide control						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
13	7.1 Explain the need for effective field drainage	<ul style="list-style-type: none"> • Give definitions and effects of drainage. • Explain need for drainage 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> • Differentiate between surface and tile drainage 	<ul style="list-style-type: none"> • Visit Drainage site with students • Identify different drainage systems. • Differentiate between surface and tile drainage 	Boards, drawings, slides and pictures, Drainage site.
	7.2 Identify the sources of drainage problems	<ul style="list-style-type: none"> • Explain the possible causes of different drainage problems such as salt deposits ,water logging etc 	Boards, drawings, slides and pictures	<ul style="list-style-type: none"> • Identify symptoms and sources of drainage problems 	<ul style="list-style-type: none"> • Visit the field to identify symptoms and sources of drainage problems. 	Drainage site.
14	7.3 Design the layout of drainage systems.	<ul style="list-style-type: none"> • Explain steps involved in planning the layout of drainage systems. 	Board, cardboard drawings.	<ul style="list-style-type: none"> • Know how to plan layouts for drainage structures. 	<ul style="list-style-type: none"> • Carry out layout of drainage structures • Visit Drainage site 	Irrigation sites
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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 208		Contact Hours: 2 – 0 - 0
	Subject/Course: Engineering Measurements, Evaluation and Specifications			Theoretical: 2 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite:	Practical: 0 hours /week

GENERAL OBJECTIVES:

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

- 1) Understand the duties and relationship of professional in connection with Water Resources Engineering Contracts**
- 2) Know the main purpose of Water Engineering Measurement And Evaluation**
- 3) Understand the choice of the methods of preparing Water Engineering Measurements and Evaluation**
- 4) Understand the general principles and rules to be followed in taking- off of Engineering Measurements and Evaluation**
- 5) Know the methods of measuring quantities for sub-structure from drawings of a small dwelling and Civil Engineering structure using standard methods of measurements.**
- 6) Analyze and build up unit prices and rate for civil engineering works including pricing of preliminary items.**
- 7) Understand the principles of abstracting and billing.**
- 8) Understand the principles of specification writing.**

PROGRAMME: WATER RESOURCES ENGINEERING TECHNOLOGY: NATIONAL DIPLOMA						
COURSE: Engineering Measurements, Evaluation and Specifications			COURSE CODE: WRE 208		CONTACT HOURS: 2 – 0 - 0	
GOAL: This course is designed to enhance the student’s knowledge of the principles of Engineering Measurement, Evaluation and Specification						
COURSE SPECIFICATION: : Theoretical Content				Practical Contents:		
General Objective 1.0: Understand the duties and relationship of professional in connection with Civil Engineering Contracts						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	1.1 List the functions of all professionals in the construction industry. 1.2 State the relationship between the cost engineer, quantity surveyor, architect, structural Engineer and civil engineer etc in the construction industry	Illustrate with good examples activities in 1.1 to 1.2. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
Week	General Objective 2.0: Know the main purposes of Civil Engineering Measurement And Evaluation.					
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	▪ Lectures ▪ Illustrate procedure for preparing BEME and BOQ	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪

	certificate and variations 2.7 Use BEME as a basis for cost analysis and planning					
Week	General Objective 3.0: Understand choice of the methods of preparing Civil Engineering Measurements and Evaluation					
7	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. Give the advantages and disadvantages of both methods	Illustrate with good examples activities in 3.1 to 3.3. <input type="checkbox"/> Assess the student	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
Week	General Objective 4.0: Understand the general principles and rules to be followed in taking-off of Engineering Measurements and Evaluations.					
10	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	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 (CESMM). 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.	<ul style="list-style-type: none"> ▪ Lectures ▪ Illustrate use of work sections in CESMM ▪ Illustrate use of coding in CESMM work sections 	<ul style="list-style-type: none"> ▪ CESMM ▪ SMM 	▪	▪	▪

	4.8 Use ampersand in taking-off. 4.9 Use NIL in altering dimensions. 4.10 Determine the need for adjustment of openings and voids.					
General Objective: 5.0: Know the methods of measuring quantities for sub-structure from drawings of Civil Engineering structures (which includes water structures) using standard methods of measurements.						
12	5.1 Measure quantities for excavation and earth work in sub-structure 5.2 Measure quantities for all concrete work in sub-structure 5.3 Measure quantities for all block work in substructure of Civil Engineering works including building. 5.4 Measure concrete ancillaries: formwork and reinforcement for simple engineering project 5.5 Measure excavation and earthwork for pipeline project 5.6 Measure concrete work for water reservoir 5.7 Measure steel work for water reservoir water towers	<ul style="list-style-type: none"> ▪ Lecture ▪ Give assignment ▪ Illustrate the use of Taking-off, abstract and billing sheets ▪ Describe purpose of columns in billing sheets 	Drawing Scale rule Calculator Taking-off sheet Abstract sheet Billing sheet	▪	▪	▪
General Objective 6: Analyze and build up unit prices and rates for Civil Engineering works including pricing of preliminary items.						
14	6.1 Build up unit prices and analyses rates for all materials required for Civil Engineering works. 6.2 Price preliminary items for engineering works. 6.3 Price temporary works and services for engineering works.. 6.4 Prepare schedule of materials. 6.5 Calculate pro-rata rates. 6.6 Build up rates for:	<ul style="list-style-type: none"> ▪ Lectures ▪ Give assignment ▪ Provide drawing ▪ Provide of rates. 	Market survey Scale of fee Equipment hire rates	▪	▪	▪

	<ul style="list-style-type: none"> a. Concrete work b. Pipe work, fittings and c. Drainage and External Works <p>6.7 Build up unit rates for:</p> <ul style="list-style-type: none"> a. surface excavation, trenches and isolated holes, earthwork support to simple excavations, basement excavation, disposal of spoil hardcore. b. formwork and reinforcement. c. Retaining Walls. 					
General objective 7.0 Understand the principles of abstracting and billing.						
15	<p>7.1 Abstract the squared dimensions from the taking-off sheets into an abstract sheet in recognized order.</p> <p>7.2 Prepare bill of engineering measurement from a given abstract sheet in a recognized order</p>	<p>Illustrate with good examples activities in 7.1 to 7.2.</p> <ul style="list-style-type: none"> ▪ <input type="checkbox"/> Assess the student 	Abstract sheet Billing sheet	▪	▪	▪
General Objective 8.0: Understand the principles of specification.						
15	<p>8.1 Define specification.</p> <p>8.2 Explain the different types of specifications.</p> <p>8.3 State the importance of specification.</p>	<p>Illustrate with good examples activities in 8.1 to 8.3.</p> <ul style="list-style-type: none"> • <input type="checkbox"/> Assess the student 	Lecture facilities	▪	▪	▪
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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 210		Contact Hours: 1 – 0 - 2
	Subject/Course: Water Quality Assessment			Theoretical: 1 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite:	Practical: 2 hours /week

General Objectives :

On completion the student is expected to be able to;

- 1.0 Know the fundamental concepts of water quality**
- 2.0 Understand relationship between Water quality and public health**
- 3.0 Understand principle of water sampling and laboratory analysis**
- 4.0 Know water quality standards**
- 5.0 Know water contaminants and their classification**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Water Quality Assessment			CODE: WRE 210	CONTACT HOURS: 1 – 0 - 2		
Course Specification: THEORETICAL CONTENT 1 hour			PRACTICAL CONTENT 2 hours			
Week	General Objective 1.0: Know the fundamental concepts of water quality					
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
1 -2	1.1 Define water quality 1.2 State the roles of water quality laboratory 1.3 Enumerate characteristics of water. 1.10 Explain physical and chemical characteristics of water 1.11 Explain biological and microbiological characteristics of water	<ul style="list-style-type: none"> Define water quality Explain the concepts of water quality characteristics Explain the concept of water quality standards for various uses 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, markers,	<ul style="list-style-type: none"> Know laboratory practices and safety. 	<ul style="list-style-type: none"> Laboratory visit 	<ul style="list-style-type: none"> Water quality laboratory
	General Objective 2.0: Understand relationship between water quality and public health					
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
3– 4	2.1 Explain the concepts of water quality and health 2.2 Explain the following classes of water related diseases: a. Water borne diseases b. Water washed diseases c. Water based diseases d. Water related insect vector diseases	<ul style="list-style-type: none"> Explain the implications of poor quality water for various purposes State types of water related diseases 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, Magnetic Board, flip charts, markers, M&E chart, etc.	▪	▪	▪

General Objective 3.0: Understand principles of water sampling						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
5 – 7	3.1 State the objectives of water sampling 3.2 Explain the water sampling requirements 3.3 Describe water sampling methods based on water source 3.4 Explain water sampling locations and distribution of sampling points for various water schemes	<ul style="list-style-type: none"> • Explain the concepts of water sampling 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	<ul style="list-style-type: none"> • Demonstrate water sampling of following sources: <ol style="list-style-type: none"> a. Tap b. Boreholes c. River/stream d. Dam 	<ul style="list-style-type: none"> • Conduct and supervise water sampling of various water schemes 	<ul style="list-style-type: none"> • Sample bottles, sample labels, pen/marker, etc
General Objective 4.0: Know water quality standards						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
8 – 9	4.1 Explain concepts of water quality standard 4.2 Explain water quality standard for the following uses: a. Drinking b. Industrial c. Irrigation d. Fishery	<ul style="list-style-type: none"> • Explain concepts of water quality standards • Explain the Nigerian standard for drinking water quality(NSDWQ), WHO,EEC. 	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, Magnetic Board, flip charts, markers.	<ul style="list-style-type: none"> • Know the importance of water quality standards • Compare results obtained in objective 3 with the Nigerian standard for drinking water quality (NSDWQ), WHO, EEC. 	<ul style="list-style-type: none"> • Explain whether the test results are in consonance with existing standards or not 	<ul style="list-style-type: none"> • Nigerian standard for drinking water quality (NSDWQ), WHO,EEC Standards
General Objective 5.0: Know water contaminants and their classification						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
10 - 14	5.1 Explain causes of impurities in water 5.2 State types of impurities	<ul style="list-style-type: none"> • Explain the concepts of water contamination and effects. 	Instructional Manual. Recommended textbooks, e-books, lecture notes,	<ul style="list-style-type: none"> • Carry out analyses of physical ,chemical and bacteriological 	<ul style="list-style-type: none"> • Demonstrate and supervise practicals 	Turbidity meter, EC/TDS meter, various glassware of different

	<p>in water</p> <p>5.3 Explain the following physical parameters with their methods of analysis: Colour; Turbidity; Taste & odour; Electrical conductivity, total solids, suspended solids, Temperature</p> <p>5.4 Explain the following chemical parameters with their methods of analysis: pH; Acidity; Alkalinity; Hardness, Total dissolved solids (TDS); Salinity; Nitrates; Iron; Chloride,</p> <p>5.5 Enumerate the requirements for microbiological spread</p> <p>5.6 Mention the requirements for bacterial growth in the laboratory</p> <p>5.7 Explain indicator organisms for Bacteriological (Microbiological) detection</p>	<ul style="list-style-type: none"> • Explain water quality parameters 	<p>Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, action plan sample format, etc.</p>	<p>water quality parameters</p> <ul style="list-style-type: none"> • Write water quality practical report 	<p>for physical ,chemical and bacteriological water quality parameters</p> <ul style="list-style-type: none"> • Evaluate practical reports 	<p>capacities, oven, filter, paper, analytical balance, pH meter, titration apparatus, spectrophotometer, total acidity reagents, total alkalinity reagents, total hardness reagents, Iron reagents, chloride reagents, nitrate reagents, membrane filtration set, membrane filter paper, microbiological glassware e.g. petri dishes, stirring rods, incubator. relevant media for total coliform, relevant media for faecal coliform, oven, filter paper, colony counter, graph paper, autoclave etc</p>
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	<p>5.8 Describe techniques for detection of coliforms</p> <p>5.9 Mention the Advantages and Disadvantages of each method.</p> <p>5.10 Microscopic examination of biological parameters e.g. Protozoa Helminth, Algae, Bacteria Viruses</p>					
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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.

SOME REFERENCE MATERIALS:

1. APHA-AWWA-WEF (American Public Health Association – American Water Works Association – Water Environment Federation (1992), Standard Methods for the Examination of Water and Wastewater 18th edition, Arnold E.G., Lenore S.C and Andrew D. E(eds), APHA – AWWA – WEF, Washington D.C. pp 2-1 – 9-132
2. Cairncross S. and Feachem R. (1983) Environmental Pollution Health Engineering in the Tropics: An Introductory Text, John Wiley and Sons, Great Britain
3. Feachem R., McGarry M. and Mara D. (1980) Water, Waste and Health in Hot Climates, John Wiley and Sons, New York, USA.
4. InceH.G. and Smith M. (2003) Rapid Assessment of Drinking Water Quality: A handbook for implementation of Joint Monitoring Programme for Water Supply and Sanitation, Water Engineering and Development Centre (WEDC), Loughborough University, Leicestershire LE11 3TU UK.
5. Standard Organization of Nigeria (2007) National Standard for Drinking water Quality, NIS 554:2007, SON, Abuja, Nigeria
6. TebbuttT.H.Y. (1995) Principles of Water Quality Control, 4th Edition, Pergamon Press, Great Britain
7. WHO (World Health Organization) (2004,) Guidelines for drinking water quality, WHO Geneva.

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 212		Contact Hours: 2 – 0 - 2
	Subject/Course: Drilling Technology			Theoretical: 2 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite:	Practical: 2 hours /week

General Objectives

- 1.0 Understand drilling technology concept**
- 2.0 Understand rotary drilling operation**
- 3.0 Understand borehole construction and completion processes**
- 4.0 Know how to carry out pumping test of a completed borehole**
- 5.0 Understand borehole rehabilitation procedure**
- 6.0 Know the importance of safety in drilling**
- 7.0 Understand alternative well construction methods**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Drilling Technology			Course Code: WRE 212		Contact Hours: 2 – 0 - 2	
Course Specification:			Theoretical Content: 2hrs		Practical Content: 2 hrs	
GOAL: The course is designed to acquaint student with skills in water well drilling and construction.						
Week	General Objective 1.0: Understanding drilling technology concept					
1-3	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Define water well drilling 1.2 Outline different types of rigs used in water well drilling 1.3 Describe the components of a rotary rig 1.4 Explain the functions of different components 1.5 Describe the operating principle of cable tool and rotary methods of drilling 1.6 Explain types of drilling bits 1.7 State the factors guiding selection of bits for a particular formation 1.8 List the various method of selecting appropriate drilling site	1.Explain the process of drilling 2.Explain various rig designs and their capabilities 3List the advantages and disadvantages of different methods of drilling 4 List different formations and identify the bits that can be used in such formations	Drawings Pictures Power point, Projector, lecture notes	1.Conduct field trip to a drilling site 2.Identify different components of the rig	1.Coordinate field trip 2. Show student samples of old bits	Drilling rig, Tricone bits, drag bits, Hammer bits
Week	General Objective 2.0: Understand rotary drilling operation					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
4-5	2.1 Explain the process involved in rotary drilling operations 2.2 Name the various forms of rotary drilling- mud drilling, air drilling and foam drilling 2.3 Explain the importance of	1.Name the different additives used in preparing drilling mud 2.Outline the differences in the behavior of polymers and Bentonite	Projectors, White board Markers	1.Measure mud viscosity and density 2.Identify different components of Down the Hole	1. Prepare a drilling mud 2.Dismantle a hammer bit 3.Supervise practical work 4 Assess students	Bentonite, CMC, Hammer bit, Marsh funnel, mud balance, stop watch.

	drilling mud 2.4 Describe the various ways of monitoring mud during drilling 2.5 Explain the operation of down the hole hammer 2.6 Explain the processes involved in cable tool or percussion drilling as well as its advantages and disadvantages	3State guidelines for successful hammer operation		Hammer		
Week	General Objective 3.0: Understand Borehole construction and completion processes					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
6-8	3.1 Distinguish between casings and screen 3.2 Name the various types of casings and screens used in water well industry 3.3 Explain the factors that govern the selection of different type of casings 3.4 Explain the factors that govern the selection of screen 3.5 Describe the methods of installing casings and screens 3.6 Describe the process of gravel packing 3.7 Understand different methods of well development 3.8 Describe well disinfection process 3.9 Explain how to grout a borehole	1.State the conditions under which the use of P.V.C. casings and screen is feasible 2. Explain the precautions that should be taken when installing casings and screen 3. Give reason why rock chippings should not be used for gravel packing. 4.Highlight factors that can affect well development 4. Outline the need for grouting	Instructional materials, power point, projectors, pictures.	1. Carry out practical on installation of casing and screen in a drilled well 2.Carry out development in a borehole	1.Supervise practical exercise 2. Explain the danger of using excessive pressure during development	Drilling Rig, Casings, screens, compressor

Week	General Objective 4.0: Know how to carry out pumping test of a completed borehole					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
9-10	4.1 Define pumping test and various terms associated with pumping test like static water level, dynamic water level, discharge, drawdown, etc. 4.2 Outline the procedure of measuring water level and discharge 4.3. Explain how to record data collected 4.4 Explain how to determine well yield and aquifer parameters 4.5 State how to select appropriate pump for a borehole based on pumping test	1. List materials required for pump testing 2. Explain the difference between constant discharge test and step discharge test 1.3 Explain the use of observation well 1.4 Use data from a pumped well to demonstrate how to calculate aquifer parameters and selection of pumps	Instructional manual, graphs ,flip chart	1. Carry out practical on pumping test and selection of pump 2. Write a report on the exercise	1. Explain the operation of water level indicator 2. Demonstrate how to use bucket of known volume and V notch weir to measure discharge 3. Write out time intervals of taking readings during pumping test 4. Assess report submitted by students 5. Demonstrate the use of characteristics curves to select appropriate pump	Submersible pumps, water level indicators, stop watch, buckets, V notch weir, pumping test forms, generator
Week	General Objective 5.0: Understand borehole rehabilitation procedures					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
11	5.1 State causes of borehole deterioration 5.2 Explain the procedures of rehabilitating a broken down borehole 5.3 Explain what is meant by flushing and its significance 5.4 Explain the importance of borehole camera in borehole rehabilitation works	1. Explain the indicators to show that a borehole require rehabilitation 2. Sketch some fishing tools 3. Explain the operation of the tools sketched	Projectors ,markers, flip chart	Conduct Practical's on the use of borehole camera	Identify the various components of borehole camera Guide the student on how to operate the camera Use the information collected from the exercise to determine the condition of the	Borehole camera, compressor, plumbing tools, deep meter, graph sheets

					borehole	
12	General Objective 6.0: Know the importance of safety in drilling					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	6.1 Define safety 6.2 State the importance of safety 6.3 List the possible causes of accident and physical injuries during drilling operation 6.4 Highlight preventive measures for 6.3 6.5 Outline the safety responsibilities of management, supervisors and drilling crew	1. Enumerate causes of workplace accident and physical injuries 2. Explain general safety practices for drilling crew 3. Explain how safety rules can be enforced by management and workers	Instructional manual, power point, projectors, safety logos	▪	▪	▪
	General Objective 7.0: Understand alternative well construction methods					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
13-14	7.1 Name the equipment used in hand drilling 7.2 Explain the process of borehole construction using hand drilling 7.3 Explain jetted wells	1 List the advantages and disadvantages of hand drilling method 2. Explain the limitation of the method	Power point, projectors	Watch documentary or video films on hand drilling Carry out inspection of tools used for hand drilling	Supervise film or video presentation Display hand drilling tools	Video films, Computer, Projectors, hand drilling tools and pumps
ASSESSMENT: The continuous assessment, tests and quiz 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.						

	Department/ Programme: ND Water Resources Engineering Technology	Course Code: WRE 214		Contact Hours: 1 – 0 - 2
	Subject/Course: Hydrometry			Theoretical: 1 hours/week
	Year: 1I	Semester: 2nd	Pre-requisite: WRE 102	Practical: 2 hours /week

General Objectives

- 1.0 **Understand the types, installation and maintenance of gauging stations**
- 2.0 **Understand water level measurements and installation procedures**
- 3.0 **Understand principles of discharge measurement.**
- 4.0 **Understand the principles of discharge computation.**
- 5.0 **Understand the basics of gauging station management.**
- 6.0 **Know the basic concepts of sediment discharge and water quality measurements.**

PROGRAMME: ND Water Resources Engineering Technology						
Course: Hydrometry		Course Code: WRE 214		Contact Hours: 1 – 0 - 2		
Course Specification:		Theoretical Content: 1 hrs		Practical Content: 2 hrs		
Year: ND II	Semester: 2			Prerequisite : WRE 102		
Course Objectives 1.0: Understand the types, installation and maintenance of gauging stations						
Week	General Objective 1.0:					
1-2	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Explain Hydrometry 1.2 Describe features and components of a gauging station 1.3 Describe the criteria used in selecting gauging station. 1.4 Describe types of channel conditions.	<ul style="list-style-type: none"> Lecture Illustrate with relevant diagrams. 	<ul style="list-style-type: none"> Instructional Manual. Recommended textbooks, lecture notes, PowerPoint, Projector & Screen, 	<ul style="list-style-type: none"> Identify some gauging stations 	<ul style="list-style-type: none"> Develop practical manual, 	
Week	General Objective 2.0: Understand water level measurements and installation procedures.					
3-4	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	2.5 Explain water level/stage 2.6 Describe types of water level instruments. 2.7 Show the usage and maintenance of water level instruments. 2.8 Explain the installation of the various water level instruments. 2.9 Explain errors affecting water level measurements.	<ul style="list-style-type: none"> Lecture and show the students the various instruments used in measuring water level. Show how to install water level instruments. 	<ul style="list-style-type: none"> Instructional Manual. Recommended textbooks, e-books, lecture notes, PowerPoint, Projector & Screen, Magnetic Board, flip charts, Water level instruments 	<ul style="list-style-type: none"> Identify various water level instruments. Carry out installation of water level gages. Carry out maintenance of water level gages. Keep a record of water level readings. 	Prepare the equipments for the outdoor activity	Water level instruments

Week	General Objective 3.0: Understand principles of discharge measurement and estimations.					
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
5-6	3.1 Explain the terms: discharge, stream flow, and runoff. 3.2 Explain the different methods of discharge measurement. 3.3 Describe the different instruments needed for discharge measurement. 3.4 Describe methods of velocity measurement. 3.5 Explain the different indirect methods of discharge measurement. 3.6 Explain the errors affecting discharge measurements	<ul style="list-style-type: none"> Lecture Show the equipments necessary for discharge measurement. 	<ul style="list-style-type: none"> Marker, board, Water level gages Current meter. Float Typical solution etc	<ul style="list-style-type: none"> Identify the different types of current meters Carryout outdoor activities to measure discharge by direct and indirect methods. Carry out the maintenance of current meters. Convert water levels record to discharge record. 	<ul style="list-style-type: none"> Develop practical manual for exercises in this course. Prepare practical as indicated in the manual. Identify working components of current meters. 	<ul style="list-style-type: none"> Practical manual, Rainfall gauges of different types,
Week	General Objective 4.0: Understand the principles of discharge computation and discharge rating curve.					
7-8	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	3.1 Explain the different methods of discharge computation. Like arithmetic and graphical method etc 3.2 Explain stage-discharge relationship 3.3 Explain the construction of discharge rating curve 4.2 Explain extension of stage-discharge curve 4.3 Describe the factors affecting stage-discharge relationship	<ul style="list-style-type: none"> Show examples of discharge computations Illustrate the construction of discharge rating curve 	<ul style="list-style-type: none"> Marker, board and projector 	<ul style="list-style-type: none"> Develop stage-discharge curve Compute the discharge of a river 	<ul style="list-style-type: none"> Coordinate the activities 	<ul style="list-style-type: none"> Computer and related software

Week	General Objective 5.0: Understand the basics of gauging station management.					
9-10	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	4.1 Describe conditions affecting gauging station stability. 4.2 Explain the factors affecting level checks and discharge measurements. 4.3 Describe station management plans.	<ul style="list-style-type: none"> ▪ Lecture ▪ Draw a gauging station management plan. 	<ul style="list-style-type: none"> ▪ Marker and board 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪
Week	General Objective 6.0: Know the basic concepts of sediment discharge and water quality measurements					
10-12	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	5.1 Explain sediment production in a river channel/water reservoir. 5.6 Outline the factors affecting sediment production. 5.7 Explain various methods of sediment measurement. 5.8 Explain determination of daily mean sediment concentration.	<ul style="list-style-type: none"> ▪ Lecture ▪ Perform illustration by solving a calculation based problem 	<ul style="list-style-type: none"> ▪ Marker and board, ▪ PowerPoint ▪ Projector and screen, ▪ Sediment sampler ▪ Water sample bottles. 	<ul style="list-style-type: none"> ▪ Carryout water sampling from a given river channel ▪ Compute sediment concentration using various methods. ▪ Draw sediment-rating curve. 	Select a suitable site and coordinate the activities	Sampling bottles, sediment sampler
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.						

STUDENTS' INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

PROGRAMME: WATER RESOURCES 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 methods.
7. **Acquire practical skills in areas of surveying relevant to civil engineering**
8. **Understand the processes and soil analysis in highway construction**
9. **Understand the production of concrete used in civil engineering works**

iv. Water and Waste Water Experiences

10. Acquire basic skills in the analysis of water and waste water.
11. Know the construction processes of water and waste water structures.
12. Know the general procedure for data collection and the importance of contract documents.

v. Log-Book and Supervision of SIWES

13 Appreciate the importance of keeping accurate record of work experience.

14 Appreciate the importance of the host company’s monitoring SIWES students.

15 Appreciate the importance of polytechnic’s supervision SIWES student as related to his Professional training

Course: Industrial Training		Course Code:	Duration: 4 Months
Course Specification: Theoretical Content			
General Objective 1.0: Understand the objective and structure of the organization			
Week	Specific Learning Outcome	Teachers Activities	Resources
	1.1 List the objectives of the organisation. 1.2 Draw the organization 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	<ul style="list-style-type: none"> Supervise the students on monthly basis to check logbook in accordance with the expectations here Request and mark reports, Grade report and submit to SIWES office 	
General Objective 2.0: Understand simple civil engineering drawing.			
Week	Specific Learning Outcome	Teachers Activities	Resources
	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.	Supervise the students on monthly basis to check logbook in accordance with the expectations here <ul style="list-style-type: none"> Request and mark reports, Grade report and submit to SIWES office 	
Course Specification: Theoretical Content			
General Objective: 3.0 Understand the properties of cement and concrete and the different ways of storing cement.			
Week	Special Learning Objective:	Teachers Activities	Resources
	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 compressive strength test. 3.5 Participate in the construction of silos for storage of cement on large sites.	Supervise the students on monthly basis to check logbook in accordance with the expectations here <ul style="list-style-type: none"> Request and mark reports, Grade report and submit to SIWES office 	

	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.			
Week	Special Learning Objective:	Teachers Activities	Resources
	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 in-situ tests such as slump, preparation of cube moulds etc.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports, Grade report and submit to SIWES office	
Course: Industrial Training		Course Code:	Duration: 4 Months
Course Specification: Theoretical Content			
General Objective 5.0: Acquire skills in investigations of soil for foundation.			
Week	Special Learning Objective:	Teachers Activities	Resources
	5.1 Perform the following on soil with appropriate tools 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, borehole draw-down and consolidation. 5.2 Draw curves and compute appropriate data for the above tests.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports, Grade report and submit to SIWES office	
General Objective 6.0: Know various foundation construction methods.			
Week	Special Learning Objective:	Teachers Activities	Resources
	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.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	

	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.		
Course Specification: Theoretical Content			
General Objective 7.0: Acquire practical skills in areas of surveying relevant to civil engineering.			
Week	Special Learning Objective:	Teachers Activities	Resources
	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 leveling 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 plan, cross-section, profiles and contours. 7.8 Determine areas and volumes from survey data.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	
General Objective 8.0: Understand the processes and soil analysis in highway construction.			
Week	Special Learning Objective:	Teachers Activities	Resources
	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 d other geotechnique tests.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	
Course Specification: Theoretical Content			
General Objective 9.0: Understand the production of concrete used in civil engineering works.			
Week	Special Learning Objective:	Teachers Activities	Resources

	<p>9.1 Produce different grades of concrete on site using various methods e.g manual, mixer, batching plant.</p> <p>9.2 Carry out the following tests: slump test and cube test.</p> <p>9.3 Use various methods to cure concrete on the site.</p> <p>9.4 Participate in the construction of different types of formwork used on site e.g. smooth, wrought, swan, including steel form work.</p> <p>9.5 Understand the different types of shuttering used in highway works (e.g. in culverts and bridges).</p> <p>9.6 Read and interpret the bar bending schedule used in high way structures</p>	<p>Supervise the students on monthly basis to check logbook in accordance with the expectations here</p> <ul style="list-style-type: none"> • Request and mark reports Grade report and submit to SIWES office 	
General Objective 10: Acquire basic skills in the analysis of water and waste.			
Week	Special Learning Objective:	Teachers Activities	Resources
	<p>12.1 Carry out the following tests on water samples:</p> <p>a. Physical tests e.g.colour, odor and TDS and taste.</p> <p>b. Chemical tests e.g. hardness, salinity, PH etc.</p> <p>c. Bacteriological test e.g. coliform count.</p> <p>12.2 Carry out biochemical test on waste water (BOD) and COD).</p>	<p>Supervise the students on monthly basis to check logbook in accordance with the expectations here</p> <ul style="list-style-type: none"> • Request and mark reports Grade report and submit to SIWES office 	
General Objective 11.0: Know the construction of water and waste water structures.			
Week	Special Learning Objective:	Teachers Activities	Resources
	<p>13.1 Perform setting out and excavation operation</p> <p>13.2 Build formwork for placing concrete</p> <p>13.3 Install pipes for water and waste water structures.</p> <p>13.4 Carry out plumbing operations in buildings</p> <p>13.5 Participate in drilling operations</p>	<p>Supervise the students on monthly basis to check logbook in accordance with the expectations here</p> <ul style="list-style-type: none"> • Request and mark reports Grade report and submit to SIWES office 	
General Objective 12.0: Know the general procedure for data collection and the importance of contract documents.			
Week	Special Learning Objective:	Teachers Activities	Resources
	<p>14.1 Collect specific data using appropriate equipment on appropriate record sheets.</p> <p>14.2 Analyse the data collected</p> <p>14.3 Reproduce working drawings.</p> <p>14.4 Interpret simple working drawings</p> <p>14.5 Prepare simple bills civil engineering measurement and evaluation.</p>	<p>Supervise the students on monthly basis to check logbook in accordance with the expectations here</p> <ul style="list-style-type: none"> • Request and mark reports Grade report and submit to SIWES office 	
General Objective 13.0: Appreciate the importance of keeping accurate record of work experience.			
Week	Special Learning Objective:	Teachers Activities	Resources

	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.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	
General Objective 14.0: Appreciate the importance of host company's monitoring SIWES students			
Week	Special Learning Objective:	Teachers Activities	Resources
	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.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	
General Objective 15.0: Appreciate the importance of polytechnic supervision of SIWES student asrelates to his professional training			
Week	Special Learning Objective:	Teachers Activities	Resources
	17.1 Supervise training scheme. 17.2 Assess performance on training scheme of: a. student b. host company 17.3 Grade the reports.	Supervise the students on monthly basis to check logbook in accordance with the expectations here • Request and mark reports Grade report and submit to SIWES office	

GUIDELINES FOR ASSESSMENT OF ND STUDENTS' PROJECTS

PART A: SUPERVISOR'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	
5	Total	50	

Brief Remark

NATIONAL DIPLOMA

Guidelines for textbook writers (ND AND HND)

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 world'
- 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 labelled 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 (SAQ) 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.

PHYSICAL FACILITIES

LIST OF MINIMUM RESOURCES

LIST OF PHYSICAL FACILITIES

Programme	Laboratory	Workshop	Studio/Drawing Room and Other
Water Resources Engineering Technology (ND)	1. Structures/Strength of Materials 2. Soil Mechanics 3. Concreting 4. Fluid Mechanics/ Hydraulics / Hydrology 5. Water Quality	1. Plumbing/Electrical /Mechanical 2. Drilling Technology	1. Drawing Room 2. Surveying Equipment Store 3. Computer/ Geo-informatics Studio 4. Outdoor drainage and Irrigation Facilities 5. Safety Equipment (for each Workshop)

LIST OF LABORATORY EQUIPMENT

S/No	1. A. STRUCTURES/STRENGTH OF MATERIALS (For 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
S/No	1. B. STRUCTURES /STRENGTH OF MATERIALS (For HND)	No. Required
1.	Universal testing machine (100) complete accessories	1
2.	Deflection of curved bars	1
3.	Model frame work apparatus	1
4.	Plastic bending apparatus	1
5.	Universal testing frame apparatus and accessories	1
6.	Suspension bridge apparatus	1
7.	Unsymmetrical cantilever testing apparatus	1
8.	Shear center apparatus	1

S/No	2. A. SOIL MECHANICS (for ND)	No. Required
1.	C.B.R. Apparatus	1
2.	Compacting core machine	1
3.	Particle size distribution test apparatus (manual and electrical –sieve shaker)	2 set
4.	Compaction test apparatus	3 standards
5.	Cone penetrometer	1
6.	Moisture content test apparatus	2
7.	Specific gravity test apparatus	3
8.	Density test apparatus	3
9.	Augers and rings with sampling & extruding devices	5
10.	Drying ovens	3
11.	Sampling collecting trays and sample containers	20
12.	Balances e.g. analytical balance triple beam Balance, top pan-balance, semi-automatic Balance, spring balance, chemical balance, electrical balance	2 of each
13.	Thermometers	5 of each
14.	Measuring cylinders	5
15.	Soil hydrometers	3
16.	Crucibles, spatulas, funnels	5
17.	Desiccators	6
18.	Stop watches	10
19.	Glass wares	Assorted
20.	Casagrade Liquid limit device	3
21.	Porcelain mortar & pestle	25
22.	Hand scoop	5
23.	Mallet	2
S/No	2. B. SOIL MECHANICS (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
S/No	3. A. FLUID MECHANICS/ HYDRAULICS / HYDROLOGY (for ND)	No. Required
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.	Anemometer	1
12.	Evaporation pan	1
13.	Current meters	1
14.	Point and hook gauge	2
15.	Rain gauges	1
16.	Water tank	1
17.	Barometer,	1
18.	Piezometer	1
19.	Hydrometer	1
20.	Surge tank demonstration set	1

21.	Pitot tube	2
22.	Float (hydrometry)	Assorted
23.	Stop watches	5
24.	Measuring tapes	5
25.	Meteorological station (with equipment)	1
26.	Rain fall simulator	1
27.	Water Hammer apparatus	2
S/No	3. B. FLUID MECHANICS/ HYDRAULICS / HYDROLOGY (For HND)	No. Required
1.	More hydraulic benches	Assorted
2.	Flow channel (flumes)	1
3.	Flow measuring apparatus	1
4.	Centrifugal pump test rig	1
5.	Sedimentation tank	1
6.	Permeability tank	1
7.	Bernoulli's theorem demonstration apparatus	1
8.	Hydraulic ram	1
9.	Series/Parallel pump test	1
10.	Pump characteristics text accessories	1
11.	Osborne Reynolds apparatus	1
12.	Drag coefficients of particles apparatus	1
13.	Flow meter demonstration apparatus	1
14.	Drainage seepage tank	1
15.	Standard 300mm wide tilting flow channels and models	1
16.	Hydraulic models	1
S/No	4. CONCRETING LABORATORY (For ND)	No. Required
1.	Consistency limits test apparatus	6
2.	Compacting factor machine	1
3.	Moisture content text apparatus	2

4.	Specific gravity test apparatus	3
5.	Density test apparatus	3
6.	Le Chatelier test apparatus	2
7.	V-b consistometer text apparatus	1
8.	Drying ovens	3
9.	150mm cube moulds	18
10	150mm cylindrical moulds	18
11.	Balances e.g. analytical balance triple beam Balance, top pan-balance, semi-automatic Balance, spring balance, chemical balance, electrical balance	2 of each
12.	Vicat apparatus	2
13.	Thermometers	5 of each
14.	Measuring cylinders	5
15.	Cement fineness test apparatus	2
16.	Curing tank	1
17.	Beam moulds	4
18.	Crushing machine	1
19.	Vernier calipers	2
20	Schudt rebound hammers	2
S/No	5. A. WATER QUALITY LABORATORY (For ND/HND)	No. Required
1.	Lovibond 1000 comparator	1
2.	Dissolved oxygen meter	1
3.	Turbidimeter	1
4.	pH meter	1

5.	BOD Bottle with stoppers	15
6.	Weight bottles with stoppers	15
7.	Rubber tubes	15
8.	Automatic sampler e.g. peristaltic pump diaphragm pump	Assorted
9	Filterability index apparatus	1
10	Deep-bed filter column	1
11	Permeability/Fluidization apparatus	1
12	Ion-exchange apparatus	1
13	Aeration apparatus	1
14	Jar test apparatus (set)	1
15	Sedimentation study apparatus.	1
16	Flame photo meter	1
17	Atomic Absorption spectrophotometer	1
18	Spectrophotometer	1
19	Electronic Balances (Sensitivity 0.001)	2
20	Microscopes	5
21	Oven	3
22	Refrigerator	2
23	Incubator	2
24	Petri-dishes	various
25	Glass wares	various
26	Pi-pumps	10
27	Dessicator	2
28	Burette	10
29	Pipette and holders	Various
30	Conductivity meter	1
31	Autoclave	1
32	Water bath	2

LIST OF WORKSHOP EQUIPMENT

S/No	1. PLUMBING/MECHANICAL/ELECTRICAL WORKSHOP (For ND/HND)	No. Required
1	Guillotine (three feet)	1
2	Fittings	Assorted
3	Pumps of various types (e.g. centrifugal, reciprocating pump, series and parallel pumps,	
4	submersible 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	Re-fix 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
36	Bending vices/machine	10
37	Accumulators	2
38	Electrical tool kits	4
39	Battery charging equipment	1
40	Soldering iron and equipment	10
41	Generators	1
42	Avometers	2
43	Ammeters	2
44	Volt-meters	2
45	Writing boards	Assorted
S/No	2. DRILLING TECHNOLOGY (For HND)	No. Required
	2.A Groundwater Investigation Techniques Equipment	
1	Resistivity Meter	1
2	Electrodes	Various
3	Cable Reels	Various

4	Hammers	Various
5	Data Sheets	3
6	Cable Clips	Various
7	Seismic Equipment	1
8	Software for Groundwater Investigation Analysis	-
2.B Borehole Construction Equipment		
1	Training Drilling Rigs	3
2	Tanker Trucks	2
3	Compressor	2
4	Craig Truck	1
5	Drilling Bits for Different Formations	Various
6	Drilling Pipes of Different Length	Various
7	Steel Temporary Casings	Various
8	Johnson Screens and Casings	Various
9	P.V.C. Screens and Casings	Various
10	Plumb Centralizer and Collar	2 each
11	Borehole Camera	2
12	Logging Equipment	2
13	Marsh Funnel and Mud Balance	Various
14	Drilling Chemicals like Bentonite and Extender	Assorted
15	Digging Tools like Digger and Shovel	Various
2.C Pumping Test Equipment		
1	Calibrated Dip Meter	2
2	Generator	1
3	Submersible Pump	2
4	Riser Pipes and their Accessories	Various
5	Clamp and Pipe Ranges of Different Sizes	Various
6	Data Sheets and Stop Watch	3 each
7	Container of Known Volume	Various

8	Software for Pumping Test Analysis	-
2.D Hand Pump Equipment		
1	Complete Set of Indian Mark	3
2	Complete Set of Ruwatsan	2

LIST OF STUDIO/DRAWING ROOM AND OTHER EQUIPMENT

S/No	1. STUDIO/DRAWING ROOM (For ND/ HND)	No. Required
1	Drawing table	30
2	T-Square	30
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	Templates	2 sets
12	Plastic curves	2 sets
13	French curves (metric) set	2 sets
14	Projector	1
15	Engineering scale rules	Assorted 10 each
S/No	2.SURVEYING EQUIPMENT STORE (For ND/ HND)	No. Required
1	Leveling 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
S/NO	3.COMPUTER & GIS LABORATORY (For ND/ HND)	No. Required
	Hard wares	
1	Pentium Base Computers	5
2	9 Second Total Station and Accessories	2
3	3 Seconds Total Station & Accessories(HND)	1
4	Handheld GPS (HND)	1 pair
5	EDM (HND)	1
6	Digital Theodolite	1
7	Printers	1
8	Digitizers A3 (HND)	3
	Software	1
1	DBMS	
2	SURFER-S	
3	MAPMAKERS	
4	Spreadsheet	
5	Word-processing	
5	AUTOCAD	
6	ILWIS	
7	ARCVIEW/ARCINFO/MAPINFO	

S/NO	4. OUTDOOR DRAINAGE AND IRRIGATION FACILITIES (For HND)	No. Required
1	Open channels, distributors and measuring devices (ND)	1
2	Infiltrimeters (ND)	4
3	Sprinkler testing rig	1
4	Surface drainage field demonstration	1
5	Demonstration sand table	1
6	Rainfall simulator'	1
7	Surface Irrigation model (ND)	1
8	Gauging weirs and flumes (ND)	1
9	Gauging and control structures (ND)	1
10	Test channel section (ND)	1
11	Demonstration Lysimeter (ND)	1
12	Irrigation equipment displays	1
13	Field drain filter test apparatus	1
14	Outdoor Irrigation and drainage field	1
15.		1
S/NO	5. SAFETY EQUIPMENT (For each Workshop)	No. Required
1	First aid box	1
2	Safety goggles	32
3	Safety helmet	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

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