CHUKWUEMEKA ODUMEGWU OJUKWU UNIVERSITY

FACULTY OF ENGINEERING

CIVIL ENGINEERNG DEPARTMENT

STUDENTS' HANDBOOK 2017

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PREFACE

This is the second edition of the printed version of this academic regulation. This has been prepared to provide vital and useful information for Civil Engineering Department. Hoping that all will find this useful. Suggestions for improvement are also most welcome.

Engr.
S.C. Ezekafor
Head of Department

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Chapter 1

1.1 History Of The Programme

The Anambra State University of Science and Technology now Chukwuemeka Odumegwu Ojukwu University was established on 1st January 2000 by Law No. 13 of Anambra State Government. The University was established as a result of felt need to meet the educational yearnings of the teeming population of youths in Anambra State and its environs.

The Department of Civil Engineering was established during the 2000/2001 academic session as one of the foundation departments of the Faculty of Engineering and Environmental Sciences of Anambra State University of Science and Technology, Uli now Chukwuemeka Odumegwu Ojukwu University. The Department is housed within the Engineering complex at Uli Campus. Engr. S.C. Ezekafor is currently Head of the Department but the following were the former Heads of the Department: Dr. T.C. Ogwueleka, late Prof. G.U. Ojiako, Dr. L.C. Eme, Engr. P.C.K Okika, Engr. Dr. J.I. Obianyo, and Engr. Dr. I.E. Umoanyiagu.

The Department of Civil Engineering offers a five-year Programme leading to the award of the Bachelor of Engineering (B.Eng.) in Civil Engineering. Higher degrees (PGD, M.Eng. and Ph.D.) commenced in 2007/2008 academic session. The developments in Civil Engineering Department over the years have been immense.

1.2 Philosophy and Objectives

1.2.1 Philosophy and Objectives of B.Eng. (Civil Engineering)

The philosophy of the Civil Engineering Department, Anambra State University now Chukwuemeka Odumegwu Ojukwu University is to produce graduates of high academic standard with high and adequate practical and theoretical background of immediate value in the industry and the nation in general. This will help to meet up with the national goal and objectives of industrialization and self-reliance.

The objectives of the Programme are to produce Engineering graduates who shall possess the following attributes:

i. To design Engineering projects and supervise their constructions.
ii. The ability to manage people's fund, materials and equipment.
iii. The ability to exercise original thought, have good professional judgment and be able to take responsibility for the direction of important tasks.
iv. The ability to improve on indigenous technology to enhance local problems solving capability.
v. The ability to install and maintain complex Engineering systems so that they can perform optimally in an environment

The curriculum of the Department is therefore structured as follows:

i. Foundation courses at 100 and 200 levels
ii. Broad-based background in Civil Engineering
iii. Projects that have to do with technology, laboratory work and tutorials
iv. Design projects with bias towards local applications
v. Adequate knowledge in the area of Engineering management, economics and law
vi. Six months of supervised industrial training during the second semester of the fourth year.

1.2.2 Admission Requirements:

To be admitted into the Programme, candidates seeking admission must possess the minimum entry requirements of five credits in SSCE or GCE 'O' level obtained in not more than two sittings. Candidates seeking admission into the first year of the standard five-year Programme of the Department of Civil Engineering must possess five credits in Mathematics, English Language, Physics, Chemistry and one other subject obtained in not more than two sittings as part of the above requirements. In addition, they must pass the UTME (Unified Tertiary Matriculation Examination). Candidates seeking admission into the Department through Direct Entry are required to possess a good Ordinary National Diploma (OND), National Diploma (ND) in Civil Engineering from a recognized institution or three GCE A/level papers in Mathematics, Physics and Chemistry. All direct entry candidates must apply through UTME.

1.2.3 Curriculum

(A) Course Descriptions

100-Level First Semester

Course Code	Course Title	Credit Load
MTH 111	Elementary Mathematics I	2
ENG 101	Introduction to Engineering	2
CHM 101	General Chemistry I	2
CHM 171	Practical Chemistry	1
PHY 101	General Physics	2
PHY 191	Practical Physics	1
ENG 103	Engineering Drawing I	2
GSS 101	Use of English	2
GSS 103	Philosophy, Logic and Human	2
CIS 101	Existence Introduction to Computer	2
	TOTAL	18

100-Level Second Semester

Course Code	Course Title	Credit Load
MTH 112	Elementary Mathematics II	2
CHM 102	General Chemistry II	2
CHM 172	Practical Chemistry II	1
PHY 108	General Physics II	2
PHY 192	Practical Physics II	1
ENG 102	Applied Mechanics	2
ENG 122	Workshop Practice I	2
GSS 102	Use of English II	2
GSS 106	Social Sciences	2
ENG 106	IT in Engineering	2
CVE 114	Computer Application for Civil	2
GSS 108	Engineering I Basic Communication in French	1
	TOTAL	21

200-Level First Semester

Course Code	Course Title	Credit Load
ENG 201	Engineering Mathematics	2
ENG 211	Material Science	2
ENG 281	Material Science Lab	1
ENG 241	Strength of Materials	2
ENG 271	Strength of Materials Lab	1
ENG 221	Basic Electrical Engineering	2
ENG 251	Basic Electrical Engineering Lab	1
ENG 261	Engineering Thermodynamics	2
STA 253	Statistics for Engineers	2
ENG 231	Engineering Drawing II	2
CVE 213	Computer Application for Civil	2
GSS 208	Engineering II	1
GSS 103	Peace Studies and Conflict Resolution Intro. to Philosophy (for D.E students)	1
	TOTAL	20/21

200-Level Second Semester

Course Code	Course Title	Credit Load
ENG 202	Engineering Mathematics	2
ENG 212	Workshop Practice	2
ENG 222	Workshop Technology	2
ENG 232	Fluid Mechanics I	2
CVE 214	Computer Application for Civil	2
GSS 206	Engineering III	1
ENG 292	Humanities (Nig. Peoples & Culture)	2
GSS 210	Entrepreneurship Studies 1	1
CVE 252	Basic Communication in Igbo	2
CVE 272	Basic Surveying	2
CVE 262	Intro. to Environmental Engineering Civil Engineering Drawing 1	2
	TOTAL	20

300-Level First Semester

Course Code	Course Title	Credit Load
ENG 301	Engineering Analysis I	2
CVE 321	Fluid Mechanics II	3
CVE 311	Strength of Materials II/ Lab	3
CVE 341	Engineering Geology	2
CVE 331	Civil Engineering Drawing	2
CVE 323	Hydrology	2
CVE 333	Civil Engineering Materials	2
ENG 305	Technical Report Writing	2
GSS 311	Introduction to Entrepreneurial Skills	2
	TOTAL	20

300-Level Second Semester

Course Code	Course Title	Credit Load
CVE 342	Soil Mechanics I/Lab	3
CVE 312	Theory of Structures I	3
CVE 314	Introduction to Reinforced Concrete	3
CVE 352	Structures Surveying	3
CVE 332	Concrete Technology	2
ENG 312	Entrepreneurship Studies II	2
ENG 302	Engr. Analysis II	2
	TOTAL	18

400-Level First Semester

Course Code	Course Title	Credit Load
ENG 401	Computation Methods	2
CVE 411	Theory of Structures II	2
CVE 413	Design of Steel and Timber Structures	3
CVE 431	Civil Engineering Practice	2
CVE 421	Hydraulics	2
CVE 441	Soil Mechanics II/Lab	3
CVE 451	Engineering Surveying &	2
CVE 453	Photogrammetry	2
CVE 423	Highway and Transportation Engineering Engineering Hydrology	2
	TOTAL	20

400-Level Second Semester

Programme For Industrial Attachment

1 Drawing Office Practice: Reduction of surveying and geotechnical data and presentation of design, working drawings and bar bending schedules.

2. Design Office Practice: Design of highways, building Structures, Retaining Structures, Drainage and water Foundations and earth Structures.

3. Civil Engineering material Laboratory Work: Testing and reporting on various Materials of Construction including Soils, Cement, Concrete, Asphaltic Concrete, Water and Steel Products.

4. Civil Engineering Field Practice: Surveying and Construction Operations, Site Explorations Evaluations, Construction Supervision, Construction Progress Measurements and Contract Payments.

5. IT Report.

S/N	Course Code	Course Title	Credit Load
1	ENG 400	industrial attachment	9
		TOTAL	9

500-Level First Semester

Course Code	Course Title	Credit Load
CVE 511	Theory of Plasticity	3
CVE 521	Water Resources & Environmental Engineering I /Lab.	2
CVE 541	Geotechnical Engineering I /Lab	3
CVE 551	Highway and Transportation	3
CVE 531	Engineering I/Lab	3
CVE 561	Construction Management I	3
	Seminar	
CVE 513	Electives (Only one from below)	3
CVE 553	Theory of Plates & Shells	3
CVE 523	Advanced Highway and Transportation	3
CVE 543	Eng. I	3
	Advanced Water Resources & Environmental Eng.	
	Advanced Geotechnical Engineering I	
	TOTAL	20

500-Level Second Semester

Course Code	Course Title	Credit Load
CVE 512	Design of Structures II / Studio	2
CVE 522	Water Resources & Environmental	2
CVE 542	Engineering II/Lab.	2
CVE 552	Geotechnical Engineering II /Lab	2
CVE 532	Highway and Transportation	3
CVE 599	Engineering II/Lab.	6
	Construction Management II	
CVE 514	Project	
CVE 554	Electives (only one from below)	3
CVE 524	Advanced Structural Engineering I	3
CVE 544	Advanced Highway And Transportation Eng. II	3
	Advanced Water Resources &Envr. Eng. II	
	Advanced Geotechnical Engineering II	
	TOTAL	20

1.2.4. Course Content Specifications

GSS 101 USE OF ENGLISH I 2 CREDIT UNITS

Effective communication and writing in English study skills, language skills, writing of essay. Instruction on Lexis sentence construction, outline and paragraphs. Collection and organization of materials and logical presentation.

GSS 102 USE OF ENGLISH II 2 CREDIT UNITS

Punctuation and logical presentation of papers. Use o f the library, phonetics. Art of public speaking and oral communication.

GSS 103 INTRODUCTION TO PHILOSOPHY AND LOGIC 2 CREDIT UNITS

A brief survey of main branches of philosophy. Symbiotic logic, special symbols in symbolic logic-conjunction, negation, affirmation, disjunction, equivalent and conditional statements law of tort. The methods of deduction using rules of inference and

bi-conditional statements theory. Types of discourses, nature of arguments, validity and soundness, techniques for evaluating arguments, distinction between inductive and deductive inferences, etc. (illustrations will be taken from familiar texts, including literature materials, novels, law reports and newspaper publications).

GSS 106 SOCIAL SCIENCES 2 CREDITS

Concept of functional education, national economy, balance of trade, economic self-reliance, social justice, individual and national development. Norms and values. Moral obligations of citizens. Environmental sanitation.

MTH 111 ELEMENTARY MATHEMATICS I 3 CREDITS

Elementary set theory, subsets, union, intersection, complements, venn diagrams. Real numbers, in tegers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers: algebra of complex numbers, the Argand diagram, Dc Moivre's theorem, nth roots of unity. Circular measure trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 112 ELEMENTARY MATHEMATICS II 3 CREDITS

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition of scalars, multiplication of vectors, linear independence. Scalar and vectors products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry.

Straight lines, circles, parabola, ellipse, hyperbola, Tangents, normals, kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, resisted vertical motion. Angular momentum. Simple harmonic motion, classic string,

simple pendulum, impulse. Impact of two sphere and of a sphere on a smooth surface.

PHY 107 FUNDAMENTALS OF PHYSICS I 3 CREDITS
Space and time, frames of reference, units and dimension, kinematics, fundamentals of mechanics, static and dynamics, Galilean invariance. Universal gravitation, work and energy, rational dynamics and angular momentum, conservation laws.

PHY 108 FUNDAMENTALS OF PHYSICS II 3 CREDIT
Electrostatics, conductors and currents, dielectrics, magnetic field and induction, Maxwell's equations, electromagnetic oscillations and waves; applications.

PHY 191 PRACTICAL PHYSICS I 1 CREDIT UNIT
This introductory course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems; electrical and mechanical resonant system, light, heat, viscosity, etc covered in General Physics I and II.

CHM 101 GENERAL CHEMISTRY I 3 CREDIT UNITS
Atoms, molecules and chemical reaction; chemical equations and stoichiometry. Atomic structure and periodicity; modern electronic theory of atoms; radioactivity; chemical bonding; properties of gases; equilibrium and thermodynamics; chemical kinetics; electrochemistry.

CHM 102 GENERAL CHEMISTRY II 3 CREDIT UNITS
Historical survey of the development and importance of Organic Chemistry; nomenclature and classes of organic compounds; homologous series; functional group; isolation and purification of organic compounds; qualitative and quantitative organic chemistry; stereochemistry; determination of structure of organic

compounds; electronic theory in organic chemistry; saturated hydrocarbons; unsaturated hydrocarbons, periodic table and periodic properties; valence forces; structure of solids. The chemistry of selected metals and non-metals and qualitative analysis.

ENG 103 ENGINEERING DRAWING I 2 CREDIT UNITS

Drawing instruments and the use of graphic tools. Introduction drawing, measuring, lettering and dimensioning of objects in various views. Position, engineering geometry. Fundamentals of orthographic projection, first and third angle orthogonal projections, isometric projection. Graphs and presentation of data and results.

CHM 171 PRACTICAL CHEMISTRY I

Theory and practice of simple quantitative techniques.

ENG 101 INTRODUCTION TO ENGINEERING

History and philosophy of science: man – his origin and nature; man and his cosmic environment, scientific methodology; science and technology in the society and service of man, renewable and non-renewable resources – and his energy resources. Environmental effect of chemicals, plastics, textiles, wastes and other materials, chemical and radio-chemical hazards. Introduction to the various areas of science and technology.

Engineer-in-Society: History of engineering and technology; safety in engineering and introduction to risk analysis. The role of engineers in nation building, invited lectures from professionals.

ENG 102 APPLIED MECHANICS 2 CREDIT UNITS

Statistics: Law of statistics, systems of forces and their properties, simple problems. Friction, particle dynamics; kinematics of plane motion. Newton's law-kinetics of particles, momentum and energy methods, kinetics of rigid bodies; Two-dimensional motion

of rigid bodies, energy and momentum. Mass movement of inertia. Simple problems, simple harmonic motions.

ENG 211 MATERIAL SCIENCE AND CORROSION

Introduction to materials, structures, properties and processing. Mechanical behavior, thermal characteristics, responses to electric fields. Review of chemical bonding. Atomic order in solids. Atomic disorder in solids. Introduction to molecular phases, ceramics, cast irons, concrete, wood and composite materials. Introduction to corrosion to corrosion of metals and their protection.

Mechanical test, impact test, tensile test, hardness test, fatigue test, creep non-destructive test of engineering materials. Testing of magnetic materials, e.g. transformer cores. Testing of insulators, cables and transformers coil, verification of P-N junction characteristics.

ENG 201 ENGINEERING MATHEMATICS I

Series and tests for convergence of infinite sequences and series of numbers. Equations of lines and planes, matrices and determinants, Eigen values and Eigen functions, matrix solution of linear algebraic equations, dot and cross product of vectors, triple products, vector functions, the gradient, divergence and curt. Vector space. Linear dependence and independence (Wronskians and Jacobians), compute solution of matrices.

ENG 202 ENGINEERING MATHEMATICS II

Review of differentiation and integration methods. Derivation of equations from physics, chemistry, biology, geometry etc. ordinary differential equations. Second order linear equations, linear dependence and independence. Solution of second order linear differential equations by method of undermined coefficients and variation of parameters. Simple Laplace transformation. Solution of initial value problems by Laplace

transform method. Computer solution of selected engineering problems. Excel package.

ENG 311 ENTREPRENEURAL STUDIES I

Introduction to entrepreneurship and new ventures creation. Introduction to Module, learning objectives and assessment. Description of entrepreneurship. The role of entrepreneurs. Creation of new ventures, Stevenson's model, entrepreneurship resources, business plan, case studies, entrepreneurial opportunities, entrepreneurial team, entrepreneurial finance-determining capital requirements, financial strategy and managing cash flow, raising financial capital – venture capital and informal equity. Department finance and other financial instruments, marketing and new ventures product, price, place, promotion and people. Cash study new ventures workshop.

CIS 101 INTRODUCTION TO COMPUTERS

History of computers, functional components of computer, characteristics of computer, problem solving, flow charts, algorithms, computer programming statements, symbolic names, arrays, expression and control statements, introduction to basic programming and computer application.

ENG 301 ENGINEERING ANALYSIS

Complex derivatives and analytical functions. Integration-contour integration, Cauchy's integral theory, and residue theorem. Applications, rieman surfaces. Bessel equation and fast Fourier analysis. Legendre functions. Simultaneous differential equations with constant coefficients, Laplace transformation methods. Linear second order partial differential equations with constant and variable coefficients special functions.

Numerical and digital computer methods applied to various engineering problems to include matrix inversion, approximation of functions.

ENG 231 ENGINEERING DRAWING II 2 CREDIT UNITS

Pictorial/freehand sketching. Conventional practices. Introduction to computer aided drafting; electronics draughting packages. Principle and use in engineering design. Simulation packages; principle and use in engineering.

ENG 222 WORKSHOP TECHNOLOGY 2 CREDIT UNITS

Practical; use of measuring instruments; Callipers, micrometers, gauges, since bar, practice with wood planners, saws, sanders, pattern making. Machine shop; Lathe work shaping, milling, grinding, reaming, metal spinning, hand tools, gas and are welding, cutting brazing and soldering. Foundry practice.

Theoretical: Industrial safety and accident preventions, ergonomics, metrology, casting, forging, press-tool, spinning, metal joining, welding, brazing and soldering. Hear treatment. Machine tools, classification, simple theory of metal cutting. Tool action and cutting forces.

ENG 212 WORKSHOP PRACTICE II 2 CREDIT UNITS

Introduction to welding and brazing. AC and DC electric welding. Fitting and assembling, basic electric skills, testing and electrical installation and circuits including earthling, tools and machines for woodworks. Classification and uses of wood. Basic skills in brickwork and masonry. Setting out equipment using working drawings. Bonding, plumbing, leveling, gauging and erection of corners in bricks/block work.

ENG 221/251 BASIC ELECTRICAL ENGINEERING/LAB 3 CREDIT UNITS

Circuits elements, DC and AC circuits, basic circuit laws and theorems. Resonance, power, power factors, 3-phase circuit. Introduction to machines and machine designs. Physics of devices. Discharge devices, semi-conductors, diode and transistors.

Transistor characteristics, devices and circuits. Electrical and electrical power measurements.

ENG 261 ENGINEERING THERMODYNAMICS I

First law revision, second law isothermal, isentropic, polytrophic, compression, Carnot efficiency, thermodynamic cycles, refrigeration steam, gas turbines, jets and rockets, PVT relationships, equilibrium, immiscible and party miscible systems.

CVE 114 COMPUTER APPLICATION TO CIVIL ENGINEERING I(2 CREDIT UNITS)

Introductory Lecture/Studio course on creating 2-dimensional drawings using a CAD application (AutoCAD). Introduction to the AutoCAD interface/Workspace set-up introduction to 2D commands. Saving and retrieving drawings. Introduction to drawing tools; modify tools; view tool; layers tools etc. The application of these tools to elementary 2D drawing in the field of Civil Engineering.

CVE 213 COMPUTER APPLICATION TO CIVIL ENGINEERING II (2CREDIT UNITS)

A continuation from CVE 114, a Lecture/Studio course on the use of tools and tool palettes in the creation of Civil Engineering elements/drawings: walls, doors and windows, slabs, roofs and roof slabs, elevations, and sections in a CAD application environment. Principles of plotting. The effective use of the internet to source materials and collaborate with co-creators or clients across the world. The student should at the end be able to prepare 2D drawings with CAD packages such as AutoCAD.

CVE 214 COMPUTER APPLICATION TO CIVIL ENGINEERING III (2CREDIT UNITS)

Lecture/Studio course on the use of a CAD application (Sketch Up) to create 3-Dimensional drawings. The student should at the end

be able to prepare 3D drawings with CAD packages such as Sketch Up.

ENG 241 STRENGTH OF MATERIALS/ LAB (2 CREDIT UNITS)

Force equilibrium – free body diagrams. Concept of stress, strain: Tensile test. Young's module and other strength factors. Axially loaded bars, composite bars, temperature stresses and simple indeterminate problems. Hoop stresses in cylinders and rings. Bending moment, shear force and axial force diagrams for simple cases, simple torsion and application.

ENG 232 FLUID MECHANICS I (3 CREDIT UNITS)

Elements of fluid statics; density; pressure, surface tension, viscosity, compressibility etc. hydrostatic forces on submerged surfaces due to incompressible fluid. Introduction to fluid dynamics – conservation laws. Introduction to viscous flow.

CVE 252 BASIC SURVEYING (2 CREDIT UNIT)

Definition of surveying, process of surveying; taking a general view, observation and measurement, presentation, Reconnaissance, Measurement; linear, angular, Control and Checking, Maps and Plans; measuring distance from the surveyor plot, orientation, measuring area from the survey plot, measuring geometry from geometrical figures, measuring areas from ordinates: trapezoidal and Simpson's rule. Measuring area by the use of planimeter, using the planimeter. Principles of Chain surveying; check or proof lines, offsets, offsetting procedure, accuracy of measurement, maximum length of offset, field work, reconnaissance, choice of stations, station marking, field notes, procedure for taking field notes. Running the survey line, plotting the survey, overcoming field problems, the survey of woods, lakes and narrow strips, the cross staffs, the prism square, chain survey constructions, obstacles obstructing ranging but not chaining, obstacles obstructing chaining but not ranging, obstacles

obstructing both ranging and chaining. Leveling; equipment for leveling, dumping level, leveling staff, setting-up the level, 3-screw level, 4-screw level, Collimation method or height of instrument, rise and fall method, sources of error, Contouring.

CVE 272 INTRODUCTION TO ENVIRONMENTAL ENGINEERING (2 CREDIT UNITS)

Introduction to environmental chemistry and microbiology, solid waste management, hazardous waste management, environmental impact assessment, air pollution, agricultural pollution, noise pollution, water supply engineering and wastewater engineering.

CVE 311 STRENGTH OF MATERIALS II (3 CREDIT UNITS)

Further topics in bending moment and shear force in beams. Theory of bending of beams. Deflection of beams. Unsymmetrical bending and shear center, and applications. Strain energy and principles of work. Castigliano's theorems. Biaxial and triaxial state of stress. Transformation of stresses. Mohr circle. Close-coiled helical springs. Other types of springs. Strength theories stress concentration, creep fatigue and fracture, Analysis of frames, Influence Lines and rolling load.

CVE 312 THEORY OF STRUCTURES I (3 CREDIT UNITS)

Analysis of statically determinate structures: - frames, arches, trusses, suspension bridges and three dimensional structures. Graphical methods: Application to simple determinate trusses, Williot Mohr-diagrams. Deflection of statically determinate structures: Unit load method, moment-area method, conjugate beam method. Advanced topics in strain energy method. Introduction to statically indeterminate structures.

CVE 314 INTRODUCTION TO DESIGN OF REINFORCED CONCRETE STRUCTURES (3 CREDIT UNITS)

Fundamentals of design process, materials selection, building regulation and relevant codes of practice, design philosophy; elastic and limit state designs in concrete, principles of modular ratio and load factor method. Analysis of structure and analysis of sections (for bending moment, shear stress, bending stress and torsion serviceability and stability requirements). Design of structural elements in reinforced concrete e.g. Simple supported and continuous beams, slabs and short columns in buildings housing, administrative) electric power transmission poles, tanks and others. Design and detailing of reinforced concrete beams, slab, and short column.

CVE 321 FLUID MECHANICS II (3 CREDIT UNITS)

Flow measurements, Errors in measurement, flow meters. Laminar and turbulent flows, velocity distribution's Laminar flow between parallel plates and through circular tubes. Boundary layers, lift and drag. Stream function, velocity potential and application flow nets. Curved flow; equation for radial pressure variation, radial flow, free vortex flow, forced vertex flow. Dimensional analysis: Philosophy (introduction, physical dimensions, dimensional homogeneity), methods of dimensional homogeneity), methods of dimensional analysis, similitude. Applications. Steady and unsteady flow in closed conducts, including pipeline analysis: pipe network, branching pipes, Hardy cross method of pipe network analysis, hydraulic model.

CVE 323 INTRODUCTION TO HYDROLOGY (2 CREDIT UNITS)

Introduction: hydrological cycle, rainfall, and measurement of rainfall and analysis of rainfall, evaporation: measurement of evaporation, formulae and theories, their use and applications. Infiltrations: The role of infiltration in hydrological cycle, infiltration as factor of runoff and as recharge of ground water,

comparison of methods of estimating infiltration. Drainage basins and hydrographs monthly and annual runoff relations.

CVE 331 CIVIL ENGINEERING DRAWING (4 CREDIT UNITS)

A studio course in standard symbols used in plan drawing materials, construction, plumbing services. Conventions, schedules, representation of scale and orientation. Presentation and rendering techniques using different media and architectural modeling, Computer Aided Design and Drawing (CADD).

CVE* 332 *CONCRETE TECHNOLOGY (2 CREDIT UNITS)

Rheology of fresh concrete, mechanical properties of hardened concrete non-destructive testing methods and relationship between static and dynamic modulus. Elasticity, shrinkage, and creep of concrete. Durability of concrete. Lightweight and high density concrete. Pressure against formwork, maturity of concrete, mix design, production and quality control, transportation and placing of concrete, concreting equipment

CVE 333 CIVIL ENGINEERING MATERIALS (3 CREDIT UNITS)

Concrete Technology – Types of cements, aggregate – properties, concrete mix, Design, properties and their determination. Steel Technology- production, fabrication and properties: corrosion and its prevention. Test on steel and quality control. Non-ferrous metals- Aluminum, Copper, Lead, Tin and their uses. Timber: types of wood, structure, physical properties, defects, stress grading, preservation and fire protection- types and methods timber products and uses in construction. Nigerian Timber, Bituminous materials binders and their properties. Other materials: rubber, plastics, glass, lime, bricks, asphalt, tars, building stones, ceramic products, paints, varnishes, etc. Applications to building and civil engineering works.

CVE 341 ENGINEERING GEOLOGY (4 CREDIT UNITS)

Geology and its relation to Civil Engineering. Important mineral and major rock types, geologic time scale, elements of physical geology and earth history. Physical and engineering properties of rocks, principles and mechanics of rock deformation. Introduction to geology of Nigeria, construction materials, essentials of hydrogeology and engineering geology. Outlines of mineral resources of Nigeria. Engineering Applications – Water supply, site investigation, dams, dykes etc.

CVE 342 SOIL MECHANICS (3 CREDIT UNITS)

Introduction: Origin and formation of soils. Soil in water relationship, soil classification. Atterberg limits-particle size distribution. The Boussinesq problem stresses under uniformly leaded rectangular area. Settlement of elastic soil masses. Permeability and capillarity of soils. Effective stress law. Seepage forces and quicksand phenomenon. Compressibility and consolidation of soil. Earth slopes, critical height of banks, effect of pore pressures.

CVE 352 ENGINEERING SURVEYING (3 CREDIT UNITS)

Introduction to engineering surveying and principles. Chain surveying principles and methods. Measurement errors and corrections. Applications, compass surveying, methods, contours and their uses. Traversing: principles, types close and open, bearing and co-ordinates, applications. Methods rise and fall, high of collimation: errors and their adjustment. Applications- setting out, contouring, sectoring (longitudinal and cross sections). Tachometry: principles, tachometer, and types: stadia tachometry, substance heighten. Electro-magnetic measurement (EDM) principles, instrument characteristics, EDM corrections. Applications, introductions to photogrammetry, principles, types: terrestrial and aerial photogrammetry.

CVE 411 THEORY OF STRUCTURES II (2 CREDIT UNITS)

Indeterminate structural analysis: slope-deflection, moment distributions methods, three moment equation, force method and displacement method in continuous beams, rigid frames, arches and trusses. Stress Grading of timber; visual, mechanical and electronic stress grading of timber. Effects of temperature changes and movement of supports.

CVE 413 DESIGN OF STEEL AND TIMBER STRUCTURES (3 CREDIT UNITS)

Fundamentals of design process: materials selection, codes of practice. Design philosophy: elastic design, limit state design and others. Design of connections: riveted connection, bolted connections and welded connection in torsion and bending. Design of basic structural elements; beams, columns, column bases, torsion members. Timber design; allowable stresses, types of joint, fluid timber members, timber beams and trusses.

CVE 421 HYDRAULICS (3 CREDIT UNITS)

Fundamental concepts of fluid flow. Laminar and turbulent Flow. Boundary layer separation lift and Drag. Stream function, velocity potential and application to flow Nets. Steady and Unsteady flow in closed conduit. Uniform flow in open channels: open channel, uniform flow, hydraulic mean depth, hydraulic gradient, broad-crested weir and centurial flume, force equation, best hydraulic section. Non-uniform flow in open channels: energy equation for open streams, specific energy, critical velocity and critical depth, hydraulic jump, backwater curves. Surge waves. Hydraulic model. Purpose of models, laws of similitude, types of models and practical model scales. Sediment transport formulae, land drainage and inland navigation problems.

CVE 423 ENGINEERING HYDROLOGY (2 CREDIT UNITS)

Drainage basin: characteristics of drainage basin and hydrograph analysis. The unit hydrograph: Basic principles, unit hydrographs for various durations, derivation of unit hydrographs from complex storms, synthetic unit hydrograph. Flood routing: routing in a simple reservoir stream flow. Routing, frequency and duration studies. Hydraulics of wells, groundwater investigations and exploration for water. Hydraulic Structures e.g. Dams, dykes, weir, docks and harbors, spillways, stilling basins etc.

CVE 431 CIVIL ENGINEERING PRACTICE (2 CREDIT UNITS)

Civil Engineering works standards and measurements. Measurement process taking off, squaring, abstracting and billing. Measurement of concrete, steel, earthwork, demolition and site clearance, brickwork, block work, masonry, painting and waterproofing, timber pipework etc. contracts and sub-contracts: forms of civil engineering contracts- measurement contracts; bill of quantities, schedule rates. Lump sum; cost reimbursement; all in (Turnkey or package). Direct labor. Sub-contracts documents. Works construction and supervision initiation-date commencement, position and responsibilities of the contractor and engineer. Arbitration, job planning, control and decision making; program charts, bar charts critical path method, PERT etc. material planning, looser planning, cash flow control. Construction machinery and equipment. Factors affecting plant selection: foundation problems: pavement construction; concrete construction; steel construction; pipe laying; setting out; for work; use of modern equipment in finishing works. Modern techniques in construction works, influence of technology in the method of designing. Application/case study – dams, foundations bridges, highways, industrial building, sewage work.

CVE 441 SOIL MECHANICS II/LAB (3 CREDIT UNITS)

Time rate of settlement, total settlement computations, laboratory soils tests – classification and index tests, permeability, specific gravity tests, direct shear, triaxial and consolidation tests,

insitu density tests, compaction and CBR tests. Identification of rock and rock materials, physical and engineering properties of rocks. Types of foundations and their functions. Terzaghi Bearing capacity for various footing geometry. Design of isolated footings, effects of eccentricity, ground water table, footing on slopes.

CVE 451 ENGINEERING SURVEYING & PHOTOGRAMMETRY (3 CREDIT UNITS)

Use of levels and theodolite, methods of contouring, contour interpolation and use of contour plans and maps. Use of abney levels. Field works survey and design of routes, setting out of curves, sewers and drains, building etc. Application of stereoscopes, parallax bar and elementary topographical surveying. Photogrammetry setting out of Engineering works equipment and errors of measurement. Areas-Methods of measuring area, division into regular geometrical figures, trapezoidal and Simpson's rules, co-ordinates method, the planimeter, volume- prismoidal formula, grid method and contour area method.

CVE 453 HIGHWAY AND TRAFFIC ENGINEERING (2 CREDIT UNITS)

Introduction – general transportation systems.

Elementary Traffic Engineering – Transportation modes; history, development and operational characteristics. Analysis of factors in developing transportation facilities. Traffic estimates and assignments. Planning modes. Highway Design – Design Standards, factors and elements in highway design. Highway classification capacity design, design speed, traffic survey; road capacity, design volume ADT, Traffic composition, design year, traffic prediction components. Highway location surveys. Geometric design of highways. Super elevation and its attainment. Introduction of volumetric computation, Axle load surveys and calculation of traffic loads. Pavement materials and pavement components laboratory tests of pavement materials,

compaction and soil stabilization and treatment. Pavement design. Highways Administration systems, organizational structure, national and local levels. Highways financing and road taxes. Cost benefit analysis.

CVE 511 THEORY OF PLASTICITY (3 CREDIT UNITS)

Plastic analysis of structures; introduction, stress-stain relation, plastic moment, shape of plastic zones, bending moment and curvature relation, plastic hinge, collapse mechanism. Simple cases of plastic collapse; simple supported beam, fixed ended beams, rectangular portal frames. Basic theorems; Basic theorems; Uniqueness theorem, static theorem and kinematics theorems with examples. Effects of axial and shear forces in plasticity analysis of beams and frames.

CVE 512 DESIGN OF STRUCTURES II/STUDIO (2 CREDIT UNITS)

Composite design and construction in steel and reinforced concrete – long columns short columns, slabs, beam, water retaining structures, and retaining walls. Design of structural foundations. Pre-stressed concrete design: principles of pre-stressing, methods of pre-stressing, and losses of pre-stressing. Steal design; plate girders, crane girders, stanchions in multi-storey building, fire and corrosion protection devices. Complete design and detailing of complete structure in steel, reinforced and pre-stressed concrete.

CVE 513THEORY OF PLATES AND SHEELS (3 CREDIT UNITS)

Unified presentation of classical theories of plates and shells. Curvilinear coordinates, vector formulation, basic engineering applications. Emphasis of understanding of geometrical load

carrying characteristics of plate and shell structures and interpretation of numerical solutions.

CVE 514 ADVANCED STRUCTURAL ENGINEERING I (3 CREDIT UNITS)

Finite Difference, Finite Element, Matrix analysis of structures: introduction, matrix formulation of force and displacement methods, solution of trusses, plane and space frames and computer applications.

CVE 521 WATER RESOURCES AND ENVIRONMENTAL ENGR. I/LAB. (2 CREDIT UNITS)

Introduction to water supply planning: elements of population forecasting, per capita consumption rate, sources of supply. Water quality analysis. WHO standards, Waste water resources – population levels, various treatment and disposal options, Stream water quality monitoring. Oxygen sag.

CVE 522 WATER RESOURCES AND ENVIRONMENTAL ENGR. II (2 CREDIT UNITS)

Introduction to public health engineering – the sanitary engineers role, characteristics of water and wastewater, (physical, chemical and biological characteristics), Water supply, treatment and design. Wastewater collection, treatment, disposal and design. Solid waste collection, treatment, disposal and design of systems. Air pollution and control.

CVE 523 ADVANCED WATER RESOURCES & ENVIRONMENTAL ENGINEERING I (3 CREDIT UNITS)

Qualitative evaluation of water quality management alternatives. Legislation pertaining to drinking water and wastewater. Methods for environmental impact analysis, including oxygen balance, toxicity, enrichment/ eutrophication. Water and waste water treatment process technology, advanced wastewater treatment, water recycle/reuse, and industrial wastewater treatment.

CVE 524 ADVANCED WATER RESOURCES & ENVIRONMENTAL ENGINEERING II (3 CREDIT UNITS)

Study of basic laboratory principles of water chemistry, microbiology and their application to water supply, wastewater treatment and water and land control.

CVE 531 CONSTRUCTION MANAGEMENT AND ECONOMICS I (3 CREDIT UNITS)

The management of environmental: Formation of company, sources of finance, money and credit. Insurance; National policies. GNP growth rate and prediction. Organizational Management: Principles and elements of organization. Organization charts. Functions. Types. Principles of Management. Schools of thought. Office and production management. Management by objectives. Financial Management: Accounting methods. Financial statement. Elements of costing. Cost planning and control. Budget and Budgeting control. Cost reduction programmes. Depreciation accounting valuation of assets. Personnel Management: Selection, recruitment and training. Job evaluation. Merit rating. Incentive schemes. Industrial Committees and joint Consultations. Trade Unions and collective bargaining. Industrial Psychology: Individual and Group Behaviour. The learning process. Motivation and Morale. Influence of the Industrial Environment. Resources Management. Materials Management: Purchasing methods. Contracts. Interest formula. Rate of return. Methods of economic evaluation. Selection between alternatives. Tendering evaluation and contract administration. Planning and Decision Making: Forecasting Planning, Scheduling. Production control Gantt chart. C.P.M. and PERT. Optimisation. Linear programming as an aid to decision making policies under risk and uncertainties.

CVE 532 CONSTRUCTION MANAGEMENT ECONOMICS AND LAW II (3 CREDIT UNITS)

Preconstruction operations. Issuance of biding documents. Opening, acceptance and documentation of bids instruction of bidders, irregularities in the preparation and submission of bids. Analysis and comparison of bids. Unbalanced bids. Awarding of contracts. Suggestion for obtaining lowest bids. Value engineering. Managements and payments of contract stages. Meetings and negotiations, construction safety. Responsibilities and rights of the owner, responsibilities of the Engineer. Registration of professional engineers. Litigation arising from supervision of construction projects. Optimization. Linear programming as an aid to decision policies under risk and uncertainties. Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and processes

CVE 541 GEOTECHNICAL ENGINEERING I/LAB (3 CREDIT UNITS)
Review of soil bearing capacity; consolidation and settlement. Design of deep foundations, earth pressure design, types of retaining walls and functions. Design of gravity, cantilever, buttress, counterfort and reinforced earth retaining walls. Design of combined footings and raft foundation. Pile foundations and pile load test. Pile foundations subjects to lateral loads, batter piles. Caisson and pile caps.

CVE 542 GEOTECHNICAL ENGINEERING II/LAB (2CREDIT UNITS)
Design of foundation structures- design and detailing of footings, combined footing raft foundations, piles sheet pile walls. Foundations subjected to dynamic forces. Slope stability, soil structure interaction and the design of flexible bulkheads. Anchor systems for various earth structures. Seepage and surcharge effects. Site investigation. Foundations subjected to dynamic forces. Ground water control (dewatering).

CVE 543 ADVANCED GEOTECHNICAL ENGINEERING I (3 CREDIT UNITS)

Engineering geology. The behavior of rocks and soil in building and engineering construction, foundations, tunnels, dams and flood control work with reference to the importance of the mineral composition of earth and rock materials, their geomorphic and geological features and their stress history. Field investigation.

CVE 544 ADVANCED GEOTECHNICAL ENGINEERING II (3 CREDIT UNITS)

Earth structures (earth dams) and slope stability, the choices of type of dam design construction and control of dams, embankments and slopes. Principles of dams design, explorations, construction and materials, stability analysis, deformation prediction, groundwater control, construction procedures and equipment. The initial and long-term stability of earth retaining structures. Rock mechanics: introduction to rockmechanics, mining engineering, and rock excavation, drilling and blasting techniques.

CVE 551 HIGHWAY & TRANSPORTATION ENGINEERING I/LAB (3 CREDIT UNITS)

Highway planning and traffic surveys. Origin and destination studies, purpose, zoning, cordon, and internal surveys, are processing survey data. Introduction to trip generation and attraction, trip distribution, modal split and route assignment. Intersection design, types of at-grade and grade-separated intersections, assessment of intersection capacity, conflicts at intersection Traffic management; traffic signal timing, vehicle actuation, elementary signal systems, delay studies and one-way street, design of signal timing, other traffic control systems, signs and line markings. Parking control.

CVE 552 HIGHWAY & TRANSPORTATION ENGINEERING II/LAB(2 CREDIT UNITS)

Airport Engineering – classification of airports and aircraft characteristics. Planning and design of airports. Introduction to Railway engineering. Location survey and alignment. Railroad structure and design. Water Transportation – planning and siting: harbours, ports, jetties quays. Breakwaters – waves, ocean currents, littoral drifts.
The management of traffic and design of traffic signals. Parking. Geometric design. Construction methods. Highway maintenance. Highway drainage and drainage structure. Culvert design, channels, open ditches, protection of verges, side slopes, embankments against failures and erosion.

CVE 553 ADVANCED HIGHWAY & TRANSPORTATION ENGR. I (3 CREDIT UNITS)
Study of fundamental operational solutions to traffic problems, followed by a theoretical study of traffic stream flow and its parameters: fundamentals of highway signals and marking; signal system types and their design and operation. Studies of intersection gap acceptance flow density relationships, shock wave phenomena, car following models, hydrodynamic analysis, acceleration, and noise.Implications of insights of flow theory for design.

CVE 554 ADVANCED HIGHWAY & TRANSPORTATION ENGR. II(3 CREDIT UNITS)
An in-depth study and analysis of conventional and emerging public transportation state of the art systems. Brief review of conventional transportation systems, study of bus rapid systems, demand responsive bus systems, personal rapid transit, dual mode, guide way and automated freeway systems and high speed rail TACV systems. Review of current transportation administration. Systems research and demonstration programmes.

CVE 561 SEMINAR (3 CREDITS)

CVE 599 PROJECT (6 CREDITS)
The student will work on a project approved by his supervisor

1.3.0 Postgraduate Studies Programmes for the Postgraduate Diploma (PGD), Master Of Engineering (M.Eng) And Doctor Of Philosophy (Ph.D) Degrees In Civil Engineering

1.3.1 Introduction

Civil engineers plan and design, construct, operate and manage, or conduct research and development on engineering systems. These systems include buildings, bridges, tunnels, power plants, highways, airports, harbors, water supply and water treatment systems, housing and mass transit facilities, and protection of man and his environment.

The civil engineering Programme offers postgraduate programmes of course work and research leading to the award of the following degrees:

a. Postgraduate Diploma (PGD)

b. Master of Engineering (M.Eng.), Master of Science (M.Sc.)

c. Doctor of Philosophy (Ph.D.)

1.4.0 Post Graduate Diploma (PGD)

The department offers a Postgraduate Diploma in Civil Engineering.

1.4.1 Philosophy

The philosophy of postgraduate programmes in Engineering is to develop highly skilled professionals for the public, private and international organizations, as well as for teaching and research in Tertiary Institutions and for global competitiveness.

1.4.2 Aim and Objectives

The aim and objectives of the postgraduate programmes in Engineering are geared at:

- Providing students with knowledge and competitive skills to enhance their performance and to enable them to assume broader responsibilities in the rapidly changing environment in the context of the global and contemporary knowledge economy;
- Producing high level practitioners who are capable of applying appropriate engineering principles and techniques for solving problems in the local, national and international environment vise-a-visa teaching, research and industry.
- Producing socially responsive and functional engineers capable of positively driving the engine of Nigeria's economy through accelerated technology development.
- Providing opportunity for University graduates in relevant science disciplines and HND holders to convert and aspire to higher degrees in Engineering; and
- Producing Engineers in ICT having entrepreneurial skills and leadership qualities; including sound professional ethics.

- The postgraduate Diploma programme (PGD) in civil Engineering is to provide a bridging course for HND holders of polytechnics to be registrable with COREN or aspire to higher degrees, if they perform to acceptable standards. In addition, graduates of some physical or chemical sciences could be convertible to engineer via the PGD programmes.

1.4.3 Admission Requirements

The criteria for admission into the Postgraduate Diploma Programme are as follows;

i. All candidates must have five Credit passes including English, Mathematics, Physics and Chemistry O'Level.

ii. A graduate from a recognized University with at least a pass degree or a Holder of a minimum of upper Credits in the Higher National Diploma HND, from a recognized institution. Holder of the HND at lower Units with a minimum of five (5) years post-qualification relevant experience may be considered.

1.4.4 Mandatory Duration of Programmes

i. Full–time; Minimum of four (4) semesters and a maximum of six (6) semesters

ii. Part-time; minimum of six (6) semesters and a maximum of eight (8) semesters.

1.4.5 Requirements for Student Supervision

Subject to individual University peculiarities, requirements for supervision of postgraduate diploma students shall be as follows;

a. At least one supervisor for each postgraduate diploma.

A supervisor shall guide a student in his/her studies and the department shall keep a record of candidate's progress and submit a regular progress report through the Dean to Board of postgraduate studies.

b. All lecturers qualified to teach postgraduates diploma courses and who are not registered postgraduate student shall be eligible to supervise PGD.

A supervisor may be changed where and when necessary subject to the approval of the board of postgraduate studies.

1.4.6 Examinations

Course Work

a. For all postgraduate diploma coursework, the minimum pass score shall be 50%; continuous assessment shall constitute not less than 30% of the examination for each course;

b. Any student who fails in any course, shall repeat such a course; and

c. Any student whose Cumulative Grade Point Average [CGPA] falls below 2.50 at the end of 2 consecutive semesters shall be required to withdraw from the Programme.

The scoring and grading of courses shall be as follows;

Marks	**Letter Grades**	**Grade Points**
70 and above	A	5
60-69	B	4
50-59	C	3
0-49	F	0

Thesis or Dissertation

A panel of examiners shall be composed to orally assess a thesis or dissertation according to the university regulations, but the examination shall at least be guided by the following;

Postgraduate Diploma Project Report: An external examiner shall read and grade the report. The final grade for the project report shall be the average of the separate grade of an internal assessment process and the external examiner's assessment.

1.4.7 Graduation

For the PGD Programme, classification of certificates shall be based on the following:

CGPA	4.50	-	5.00	----------	Distinction
	3.50	-	4.49	----------	Upper Credit
	2.50	-	3.49	----------	Lower Credit
	1.50	-	2.49	----------	Pass

1.4.8 Academic Standards

Academic Regulations

a. **Academic Session**

An academic session consists of two semesters. Each semester normally comprises 15 weeks of teaching and two weeks of examinations.

b. **Modular System**

All engineering programmes shall be run on a modular system, commonly refers to as course Unit system. All courses should therefore be sub-divided into more or less self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Unit weights should be attached to each course.

c. **Definition of Units or Unit:**

Units are loads attached to a course. One Unit load is equivalent to one hour per week per semester of 15 weeks

of lectures or two hours of tutorials or three hours per week of term paper work or laboratory practical per semester of 15 weeks.

1.4.9 Programme Requirements

a. **Registration Procedure**

Students shall normally complete registration for courses for the semester not later than two weeks after start of the semester. A student cannot withdraw from a course after a third of it has been delivered without permission, according to the regulation of the university. A student who withdraw after this time or who fails to sit for the final examination without reason acceptable to the Senate shall be deemed to have failed that course.

b. Student Academics Status

A student's academic status shall be determined on the basis of his\her performance at the end of the semester examinations.

c. **Good Standing and Probation**

To be in good standing, a student must in each semester have a CumulativeGrade Point Average [CGPA] of not less than 2.50. A student who is not ingood academic standing shall be deemed to be on probation.

1.4.10 Withdrawal

A candidate whose CGPA is below 2.50 at the end of 2 consecutive Semesters shall be required to withdraw from the university.

1.4.11 Attendance

In order to be eligible for examination in a particular taught course, a student shall have attended a minimum of 75% of the total periods of formal instructions delivered for the course.

1.4.12 Course Evaluation

a. Attainment Levels

In engineering programmes, assessment of students' should be based on a combination of performance in some or all of the following areas:

- Examinations;
- Continuous assessment;
- Oral presentations and Seminars and problem solving exercise;
- Assignments;
- Group project works; and
- Thesis\Dissertations.

b.Continuous Assessment

Continuous assessment shall be done through essays, test, term papers tutorial exercises, quizzes and home works. Scores from continuous assessment shall constitute at least 30% of the final marks for courses which are primarily theoretical.

c. External Examiner System

The external examiner system shall be used in the final year of the graduate programme to assess final year courses and projects, and to certify the overall performance of the graduating student, as well as the quality of facilities and teaching.

1.4.13 General Course Requirements

Year One: First Sememster

S/N	Course code	Courses	Credit Load	Lecturer
1	CVE 701	Engineering Mathematics I	3	
2	CVE 703	Numerical Methods of Computer Programming	3	
3	CVE 705	Engineering Society	2	
4	CVE 707	Structural Analysis I	3	
5	CVE 709	Soil Mechanics	3	
6	CVE 711	Fluid Mechanics	3	
7	CVE 713	Civil Engineering Materials	2	
		Total	**19**	

Year One: Second Semester

S/N	Course code	Courses	Credit Load	Lecturer
1	CVE 702	Engineering Mathematics II	2	
2	CVE 704	Statistical Methods	2	
3	CVE 706	Technical Report writing	2	
4	CVE 708	Structural Analysis II	3	
5	CVE 710	Geotechnical Engineering	3	
6	CVE 712	Hydrology	2	
7	CVE 714	Civil Engineering Practice	3	
8	CVE 716	Transportation Engineering I	3	
		Total	**20**	

Year Two: First Semester

S/n	Course Code	Courses	Credit Load	Lecturer
1	CVE 721	Design of Reinforced Concrete Structure	3	
2	CVE 723	Hydraulic Engineering	3	
3	CVE 725	Transportation Engineering II	3	
4	CVE 727	Environmental Engineering	3	
5	CVE 729	Construction Management	2	
		Total	**14**	

Year Two: Second Semester

S/N	Course Lode	Courses	Credit Load	Lecturer
1	CVE 722	Law, Management of Entrepreneurship	2	
2	CVE 724	Geotechnical Engineering II	2	
3	CVE 726	Design of Structure in Steel & Timber	2	
4	CVE 728	Water Resources Engineering	2	
5	CVE 720	Project	6	
		Total	**14**	

1.4.14 Course Descriptions
Postgraduate Diploma

CVE701 ENGINEERING MATHEMATICS 1
(3 UNITS)

Review of matrix operation including inversion, Eigen values, Eigen vectors and Canonical transformation and application, threedimensional vector representation, vector calculus, gradient, divergence and curl line, surface and volume integrals, laplacian operations. Green's, Stroke and Divergence theorems and application. Ordinary and partial differential equations, applications and physical problems. Complex variables, numerical simple method of solution.

CVE703 NUMERICAL METHODS & COMPUTER PROGRAMMING (3 UNITS)

Gaussian elimination, Gauss-Seidel methods and Newton-Raphson iteration methods of solving linear equations. Forward and backward difference tables, central difference formula, finite different solution to partial differential equations, solutions of ordinary differential equations (1^{st} and 2^{nd} order) using Runge-Kutta method. (Flow charting, Algorithms, inputs and output, Basic, FORTRAN and modern languages, computer software analysis, Highway/Transportation, Geotechnical, Hydraulics/Hydrology problems and Construction Management. ICT)

CVE 705 ENGINEER-IN-THE-SOCIETY (2 UNITS)

Philosophy of science, History of engineering and technology. Safety in engineering and introduction to risk analysis. The role of engineers in nation building. Invited lectures from professional.

CVE 707 STRUCTURAL ANALYSIS 1 (3 UNITS)

Review of statistical/kinetic indeterminacy; Determination of internal, external forces and deformations in structures using MDM, slope deflection, energy equations, three moment equations, moment – area theorems, double integration, strain energy etc. influence lines.

CVE 709 SOIL MECHANICS (3 UNITS)

Review of classification techniques based on size, G.I soil. Classification systems including AASHTO, USCS etc. phase relationships in soils (consistency/atterberg limits). Field exploration stages, techniques, boring and sampling tools/equipment, disturbed sampling, SPT, Dutch cone, vane and plate loading tests, Report writing. Soli properties, consolidation and settlement, Ground water flow and see page (permeability, flow net) shear strength of soils, laboratory tests.

CVE 711 FLUID MECHANICS (3 UNITS)

Fluid properties, statics and buoyancy and stability of floating and submersed bodies. Fluid flow concepts and basic equation. Dimensional analysis, dynamic similitude. Flow of real fluid: viscous effects, resistance, compressible flows. Ideal fluid flow: rotational and irrotational flows, velocity potential, Bernoulli equation, stream functions and flow nets. Application of fluid mechanics, Fluid measurement; turbo machinery, steel closed conduct flows, steady flow in open channels. Unsteady flows.

CVE 713 CIVIL ENGINERING MATERIALS (2 UNITS)

Concrete: Physical and rheological properties of concrete.
Properties of components of concrete: cement, aggregates, water and admixtures. Trial mix design. Methods of production of Asphalts, Tars, Bitumen and Emulsion: properties and uses. Properties of Timber, Glass, plastics, Asbestos, Clay bricks, Steel and other construction materials. Alternative to OPC, line and soils.

CVE 702 ENGINEERING MATHEMATICS 11 (2 UNITS)

Complex variables: function, deviation, language series, Taylor series, Cauchy theorem, Cauchy formula, Cauchy integrals. Analytic functions, singular points, Residual problems, conformal problems and mapping. Special functions: Gamma, Delta, Bata and error functions. Fourier transforms for solving partial differential equations.

CVE 704 STATISTICAL METHODS (2 UNITS)

Descriptive statistics: Central tendencies and dispersion. Elementary probability theory, conditional probability, Baye's theorem, probability distributions and application. Elementary theories of sampling and estimation. Test of hypothesis and significance. Curve fitting, linear and multiple regression analysis; linear correlation, Analysis of variance, Time series analysis. Statistic quality control for mean, standard deviation, range,

number of defects etc., sampling techniques, average sampling number, stochastic processes.

CVE706 TECHNICAL REPORT WRITING (2 UNITS)
Principle of communications. Preparation and writing of technical reports. Oral presentation. Use of visual aids and other communication equipment in technical and research presentations.

CVE 708 STRUCTURAL ANALYSIS 11 (3 UNITS)
Matrix methods of structural analysis: Flexibility and stiffness methods, plastic analysis of structures. Finite difference and finite element techniques. Analysis of plates and thin shells. Introduction to structural dynamics.

CVE 710 GEOTHECNICAL ENGINEERING 1 (3 UNITS)
Review of structural foundations: types, choice and design. Slope stability analysis: Total stress, parallel slope, tension crack, Swedish circle, Taylor's technique, Bishop conventional, Simplified and resource methods, Factor of safety, bearing capacity: ultimate, safe and allowable. Lower and upper bound theorems, Applications.

CVE 712 HYDROLOGY (2 UNITS)
Hydrology cycle, History of hydrology, Scope and application of hydrology, climatic measurement, precipitation and precipitation analysis, Analysis of hydrologic data including statistical inferences, infiltration, Evaporation and evapotranspiration, Run off and hydrograph analysis, stream and reservoir routing, Ground water exploration and well hydraulics, design criteria for hydrochloric projects, sediment transport. Ground water exploration.

CVE714 CIVIL ENGINEERING PRACTICE (3 UNITS)

Civil Engineering as a profession: functions, training and responsibilities. Requirements for registration with professional bodies, roles and responsibilities of parties in Civil Engineering projects. Stages of Engineering project execution including conception, feasibility studies, detailed design, preparation of Civil Engineering quantities, BEME, types of contracts, preparation of contract documents, tendering procedures, evaluation and award, law of contracts, Arbitration law.

CVE 716 TRANSPORTATION ENGINEERING 1
(3 UNITS)

Introduction to different modes of transportation: Highways, railways, Air transport and Airports, water transport, dock and labors, pipelines conveyors belts. Traffic flow theory, traffic management and control, Road safety/accident analysis, Highway lighting.

CVE 721 DESIGN OF REINFORCED CONCRETE STRUCTURES
(3 UINTS)

Limit state design theory, codes of practice, Design of reinforced concrete elements: beans, columns, slabs, foundations, multi-story building. Introduction to pre-stressed concrete: Definitions, pre-tensioning and post-tensioning, Advantages/disadvantages, Losses in pre-stress, Analysis and design of pre-stressed elements.

CVE723 HYDRAULIC ENGINEERING
(3 UNITS)

Types of flows in open channels and closed conducts, turbulent flows water wave and wave characteristics. Steady and unsteady, uniform and non-uniform flow in open channels, Natural streams back water curve. Hydraulic jumps and energy dissipation. Hydraulic similitude and application to hydraulic models. Water hammer, water turbines and centrifugal pimps.

CVE 725 TRANSPORTATION ENGINEERING 11 (3 UNITS)
Route location and design, Geometric design of highways, pavement design and construction (flexible and rigid), Highway materials, Drainages and Earthworks.

CVE727 ENVIRONMENTAL ENGINEERING (3 UNITS)
Examination of water and wastewater. Collection, treatment, protection and distribution (including design of facilities) of water, municipal and industrial wastewaters. Fundamental of solid waste management, Air pollution control, stream pollution.

CVE729 CONSTRUCTION MANAGEMENT (2 UNITS)
Structure of the construction industry: Construction, planning, administration, earthworks and earth moving construction equipment, Total quality management in construction. Application of operation research techniques in construction work. Network analysis (CPM and PERT), Bar charts, progress report and charts, labor law, site safety, law of torts.

CVE 722 LAW, MANAGEMENT AND ENTREPRENEURSHIP (3 UNITS)
Principles of Management. Industrial group and organizational behavior. Motivation. Industrial law, legislation on wages, trademarks and patents, laws of contract and sales of goods. Liability for industrial injuries. Industrial relations. Trade unions, employer associations, wages bargaining and the role of the state. Relevant topics on entrepreneurship designed by the National Universities Commission for Nigerian Universities.

CVE724 GEOTECHNICAL ENGINEERING 11 (2 UNITS)
Earth pressure design: types of walls, limiting equilibrium equations, earth pressure at rest candling active and passive pressure equation and applications of gravity and counter fort walls. Coulomb methods and applications. Sheet pile walls:

cantilever and propped/anchored, revised safety factor, examples of design reinforced

CVE726 DESIGN OF STRUCTURE IN STEEL AND TIMBER (3 UNITS)

Review of design of steel members in tension, compression and bending. Design of structural steel connections. Design of beams, compound beams, columns, compound columns, industrials columns, and columns foundations. Analysis of lattice orders: Trusses, portal frames, general frames, masts, towers etc. Review of design of timber members in tension, compression and bending. Design of timber connections, beams, trusses, columns, towers, masts etc. types and properties of timber species in Nigeria.

CVE728 WATER RESOURCES ENGINEERING (2 UNITS)

Urban hydrology, drainage and land reclamation, Dam and reservoir, spillways and stilling basins, design of irrigation canals, Hydropower, River Basin Planning, water supply Engineering.

CVE 720 PROJECT (6 UNITS)

A guided/supervised individual investigation of a Civil Engineering problem in the students' chosen area of specialization under a staff direction .Student should demonstrate creative engineering ability and it will culminate into a written dissertation that will be examined and approved by a panel of examiners.

1.5.0 Masters Degree Programmes (M.Eng)

The department offers a Master's Degree programmes in Civil Engineering.

1.5.1 Philosophy

The philosophy of postgraduate programmes in Engineering is to develop highly skilled professionals for the public, private and international organizations, as well as for

teaching and research in Tertiary Institutions and for global competitiveness.

1.5.2 Aim and Objectives

The aim and objectives of the postgraduate programmes in Engineering are geared at:

- Providing students with knowledge and competitive skills to enhance their performance and to enable them to assume broader responsibilities in the rapidly changing environment in the context of the global and contemporary knowledge economy;
- Producing high level practitioners who are capable of applying appropriate engineering principles and techniques for solving problems in the local, national and international environment viz-a-viz teaching, research and industry.
- Producing socially responsive and functional engineers capable of positively driving the engine of Nigeria's economy through accelerated technology development.
- Providing opportunity for University graduates in relevant science disciplines and HND holders to convert and aspire to higher degrees in Engineering; and
- Producing Engineers in ICT having entrepreneurial skills and leadership qualities; including sound professional ethics.
- The M.Eng. / M.Sc. accords the engineer the opportunity to apply recent technological developments to the solution

of emerging Civil Engineering problem. The objective is to provide opportunity for the development of the student's professional Engineering competence and scholarly potentials. It is structured so that the student can attain academic mastery in one the areas of study within the Civil Engineering disciplines.

1.5.3 Admission Requirements

The criteria for admission into the Postgraduate Engineering programmes are as
Follows;

Basic Requirements

All candidates must have five Credit passes including English, Mathematics, Physics and Chemistry O'Level.

Master's Degree

i. A candidate with a first degree in a relevant Engineering discipline from a recognized University with minimum of a second class lower division may be admitted provided the University matriculation requirement is satisfied.

ii. A candidate with an upper credit pass in the Postgraduate Diploma (PGD), in a relevant Engineering discipline, from a recognized University may also be admitted to a Master's Degree Programme provided the University matriculation requirements are satisfied.

1.5.4 Mandatory Duration of Programmes

Master's Degree Programme

i. Full-time; A minimum of three (3) semesters and a maximum six (6) semesters.

ii. Part-time; A minimum of four (4) semesters and a maximum of eight (8) semesters.

1.5.5 Requirements for Student Supervision

Subject to individual University peculiarities, requirements for supervision of master'sdegree students shall be as follows;

a. At least one supervisor for each postgraduate student on the master degree programme shall be appointed.

b. All lecturers qualified to teach postgraduates courses and who are not registered postgraduate student shall be eligible to supervise Masters Programme.

c. A supervisor shall guide a student in his/her studies and the department shall keep a record of candidate's progress and submit a regular progress report through the Dean to Board of postgraduate studies.

d. A supervisor may be changed where and when necessary subject to the approval of the board of postgraduate studies.

1.5.6 Examinations

Course Work

a. For all postgraduate coursework, the minimum pass score shall be 50%; continuous assessment shall constitute not less than 30% of the examination for each course;

b. Any student who fails in any course, shall repeat such a course; and

c. Any student whose Cumulative Grade Point Average [CGPA] falls below 2.50 at the end of 2 consecutive semesters shall be required to withdraw from the programme.

The scoring and grading of courses shall be as follows;

Marks	Letter Grades	Grade Points
70 and above	A	5
60-69	B	4
50-59	C	3
0-49	F	0

Thesis or Dissertation

A panel of examiners shall be composed to orally assess a thesis or dissertation according to the university regulations, but the examination shall at least be guided by the following;

Master Thesis: The minimum composition of the examination panel shall comprise:

i. External Examiner;
ii. Head of Department;
iii. Supervisor;
iv. Co-supervisor [if any]; or at least one other member of the Department (if no co- supervisor); and.

v. One member appointed by the Postgraduate School.

Note that all master's degree Programmes shall be subject to external examination and moderation.

1.5.7 Graduation

For the PG programmes, classification of certificates shall be based on the following:

CGPA	4.50	-	5.00----------	Distinction
	3.50	-	4.49----------	Upper Credit
	2.50	-	3.49----------	Lower Credit
	1.50	-	2.49----------	Pass

1.5.8 Academic Standards

Academic Regulations

a. **Academic Session**

An academic session consists of two semesters. Each semester normally comprises 15 weeks of teaching and two weeks of examinations.

b. **Modular System**

All engineering programmes shall be run on a modular system, commonly refers to as course Unit system. All courses should therefore be sub-divided into more or less self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Unit weights should be attached to each course.

Definition of Units or Unit:

Units are loads attached to a course. One Unit load is equivalent to one hour per week per semester of 15 weeks of lectures or two hours of tutorials or

three hours per week of term paper work or laboratory practical per semester of 15 weeks.

1.5.9 Programme Requirements

a. **Registration Procedure**

Students shall normally complete registration for courses for the semester not later than two weeks after start of the semester. A student cannot withdraw from a course after a third of it has been delivered without permission, according to the regulation of the university. A student who withdraws after this time or who fails to sit for the final examination without reason acceptable to the Senate shall be deemed to have failed that course.

b. Student Academics Status

A student's academic status shall be determined on the basis of his\her performance at the end of the semester examinations.

c. **Good Standing and Probation**

To be in good standing, a student must in each semester have a Cumulative

Grade Point Average [CGPA] of not less than 2.50. A student who is not in

good academic standing shall be deemed to be on probation.

1.5.10 Withdrawal

A candidate whose CGPA is below 2.50 at the end of 2 consecutive Semesters shall be required to withdraw from the university.

1.5.11 Attendance

In order to be eligible for examination in a particular taught course, a student shall have attended a minimum of 75% of the total periods of formal instructions delivered for the course.

1.5.12 Course Evaluation

a. **Attainment Levels**

In Engineering programmes, assessment of students' should be based on a combination of performance in some or all of the following areas:

- Examinations;
- Continuous assessment;
- Oral presentations and Seminars and problem solving exercise;
- Assignments;
- Group project works; and
- Thesis\Dissertations.

b. Continuous Assessment

Continuous assessment shall be done through essays, test, term papers tutorial exercises, quizzes and home works. Scores from continuous assessment shall constitute at least 30% of the final marks for courses which are primarily theoretical.

c. External Examiner System

The external examiner system shall be used in the final year of the graduate programme to assess final year courses and projects, and to certify the overall performance of the graduating student, as well as the quality of facilities and teaching.

1.5.13 General Course Requirements

Courses specified for engineering disciplines are just suggestion of common courses in the various fields of engineering.

M.Sc/M.Eng. Requirements

A minimum of 31 Units comprising 24 Units of Coursework, 1 unit of seminar and 6 Units of research.

1.5.14 Admission Requirements:

a. B.Sc., B.Eng, or B.Tech. degree in Civil Engineering with at least third class (Hons) or pass degree; or.

b. B.Sc. in Building with a minimum of second class(lower)

1.5.15 Area of Specialization:

The programme provides the opportunity for students in any of the following stress areas: structures and water resources.

1.5.16 M. Eng Structural Engineering

First Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 821	Advanced Reinforced Concrete Design	3	
2	CVE 823	Advanced Engineering Analysis	3	
3	CVE 825	Advanced Structural Analysis 1	3	
4	CVE 827	Analysis and Design of Plates and Shells	3	
5	CVE 829	Advanced Design of Steel and Composite Structures	3	
6	CVE 831	Advanced Fracture Mechanics	3	
7	CVE 833	Concrete Materials	3	
		Total	**21**	

Second Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 822	Analysis and Design of Prestressed Concrete	2	

2	CVE 824	Bridge Design	3	
3	CVE 826	Advanced Foundation Engineering	3	
4	CVE 828	Advanced Structural Analysis 11	3	
5	CVE 830	Properties and Utilization of Timber	3	
6	CVE 836	Plasticity in Steel Structures	2	
7	CVE 838	Connections and Plated Structures	3	
		Total	**19**	

Electives

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 839	Deterioration and Preservation of Timbers	3	
2	CVE 841	Special Steel Structures and Products	3	

Second Year

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 840	SEMINAR	1	
2	CVE 842	THESIS	12	
		Total	**13**	

1.5.17 Course Description:

CVE 821: ADVANCED REINFORCED CONCRETE DESIGN (3 UNITS)

Aims of structural design. Factors in design function, safety, economic. Successive stages in the design process. Excellence in design, Innovation in design. The designer and the profession. The designer and the society. Basic behaviour of reinforced concrete, leading to elastic and inelastic methods of design. Introduction to

limit state concept. General review of design recommendation of BS 8110 (The structural use of concrete); comparison with ACI, DIN, NCP and other codes, where appropriate. Concept of the equivalent stress block. Design of sections in bending, shear, and a combination of axial load and bending. Design for torsion. Basic analysis of shear. Design of non-prismatic sections. Column with bi-axial bending. Design of two-way slabs by yield-line method, curtailment of positive and negative reinforcement, practical examples. Application and worked examples on the ultimate load design of continuous structures. Design of flat slab by the yield-line methods, practical examples. Point-load and line-load on slabs. Introduction to the optimum design of continuous beams. Full analysis of shear. Introduction to the design of two-way slabs by the strip beam method. Design of deep beams cracked flexibility and deflection of beams. Characteristics of materials seen from the designer's point of view; mass reinforced and pre-stressed concrete. Summary account of structural types, design factors and typical problems in bridge, harbour works, aircraft runways roads, machinery, framework and foundations, large span roofs in buildings. Typical and notable failures.

CVE823: ADVANCED ENGINEERING ANALYSIS (3 UNITS)
Reduction of matrices to triangular form by elementary matrices. Factorization by choleski's method. Schmidt orthogonalization. Existence of solutions of linear equations. Green's theorem, Eigenproblems. Basic numerical integration differentiation. Structural systems considered as assemblages of discrete structural elements; application to two dimensional solid, folded plates; axisymmetric shells and free form shells; solution techniques for large systems and for extension to dynamic analysis studies of numerical method s for structural analysis with examples, e.g. bridge decks.

CVE 825: ADVANCED STRUCTURAL ANALYSIS 1 (3 UNITS)

Review of elementary statics and kinematics. Contragredience. Static-kinematics duality. Introduction to the mesh method of elastic analysis. Introduction to the analytical methods appropriate when wind, blast and seismic loads are treated as time - varying. Types of dynamic loading. One-degree-of-freedom systems. Free and forced undamped vibrations. Resonance. Vibratory motion of support. Some half wave and rectangular impulses. Damping, free and forced viscously-damped vibrations. General impulse loading and the convolution integral. The response spectrum. Generalized coordinates. Rayleigh's method. Muti-degree-of-freedom systems. Flexibility and stiffness coefficients, D'Alembert's principle, Hamilton's principle, Lagrange's equations. Introduction to random vibration spectral analysis. The nodal method of elastic analysis. Elasto-plastic deformation analysis. Applications of mathematical programming methods to plastic analysis, elastic synthesis and plastic sysnthesis of skeletal structures. Finite element method.

CVE827: ANALYSIS AND DESIGN OF PLATES AND SHELLS (3 UNITS)

Introduction to continuum mechanics: three-dimensional theory of elasticity, basic equations and theorems. Two-dimensional elasticity plates under in-plane loading. Rectangular and circular plates in flexure: the methods of Navier and levy, the theory of membrane applied to plate bending, plates on elastic foundation. Anisotropic plates with special reference to reinforced concrete slabs. Stability and vibration of plates and plate system. Large deflection theory. Variational techniques: the methods of Ritz Galerkin and kamtorovitch. Introduction to shell theory; membrane hypothesis, cylindrical shells, shells of revolution, translational shells, shallow shell theory; the static kinematic analogy of Gol'denveiser, Lur'e and Calladine; the two-surface theory with numerical applications. Stability and vibrations of shells. Advanced shell topics.

CVE829: ADVANCED DESIGN OF STEEL AND COMPOSITE STRUCTURES (3 UNITS)

Principles of Composite Construction: Composite plates, composite beams, elastic and plastic design, composite columns. Shear connection. Static and fatigue loading. Single-storey buildings: introduction, structural forms, portal frames, plastic design, secondary effects. Behaviour and design of eccentrically restrained beams and columns. Built-up members, stressed skin design. Cranes and crane girders. Multi-storey buildings and framing. Braced, core, hull and sway structures. Behaviour and analysis of sway frames and restrained columns. Simple, semi-rigid and rigid design methods. Design of composite frames. Bridges: types of structure, loading, practical fatigue design. Plate girder design. Box girder design, composite bridges.

CVE 822: ANALYSIS AND DESIGN OF PRESTRESSED CONCRETE (2 UNITS)

Phases of design. Design philosophy. General requirements of limit state design. Thick-walled and thin-walled beam theory. Design and analysis of sections subject to bending, torsion, axial force and shear for the limit state of cracking and for the ultimate limit state. Design and analysis of statically determinate structures for the limit state deflection. Examples of the above constant and varying prestressing force. Review of recent research in the characteristics pfprestressed members. End-block design.

CVE 824: BRIDGE DESIGN (3 UNITS)

Introduction, types of Bridges, Economic span length, types of loading, Impact effect, Width of Roadway and footway, General design requirements, Design of solid slab bridges, Design and Analysis of continuous bridges.

CVE826: ADVANCED FOUNDATION ENGINEERING (3 UNITS)
Foundation Engineering from theoretical point of view. Beam on Elastic Foundations. Plates on elastic foundation. Plasticity considerations. Soil structure interaction. Advanced treatment of dewatering problems. Indeterminacy of plies and pile-Groups Seismic.

CVE 828: ADVANCED STRUCTURAL ANALYSIS II (3 UNITS)
The nodal method of elastic analysis. Elasto-plastic deformation analysis, applications of mathematical programming methods to plastic analysis, elastic synthesis and plastic synthesis of skeletal. Finite element method.

CVE 830: PROPERTIES AND UTILIZATION OF TIMBER (3 UNITS)
Botanical aspects: Structure, identification, natural defects strength properties of timbers; tension, compression, shear, bending. Factors affecting strength: defects, moisture content, density, temperature, duration of load. Grading; end use, appearance, visual and mechanical stress grading. Derivation of basis and grade stresses. Seasoning: moisture relationships, methods of drying. Biodeterioration: fungal decay and insect attack. Wood working properties. Manufacture and utilization of panel products: plywood, chipboard, fibre board. Structural forms of timber buildings: housing, industrial, educational, farming. Elementary structural analysis: beams, columns, simple trusses. Jointing methods: nails screws, bolts, connectors, adhesives. Housing requirements and standards: needs, resources, government policies and programmes, standards and economic development. Low-cost housing methods of cost limitation, urban-rural philosophy and materials. Housing construction: frame, post and beam, cross wall. Preservation: requirements, types, methods of application.

CVE 831: ADVANCED FRACTURE MECHANICS (3 UNITS)

Methods of manufacturing steel. Properties of steel, including qualitative treatment of brittle fracture, fracture mechanism and fatigue. Methods of Fabrication, tolerance and workmanship; Connection Philosophy, Welding Technology, corrosion, Fire Protection. Brittle fracture and transition temperatures. Linear-elastic fracture mechanics. Yielding mechanics. Crack-opening displacement design curves. Fatigue crack propagation. Non-destructive testing. Calculation of permissible defects. Calculation of fatigue lives.

CVE 833: CONCRETE MATERIALS (3 UNITS)

Properties and methods of testing elements, aggregates, Water and admixtures. Properties of fresh and hardened concrete. Methods of testing fresh and hardened concrete. Statistics and quality control. Design of concrete mixes. Field control of concrete. Specification, inspection and testing in the field. Construction techniques including formwork, joints, water retaining structures, surface finishes, repairs and maintenance. Application of water concrete properties to structural problems and implication of BS8110. Engineering, properties of concrete including time-dependent behavior and environmental effects. Criteria for fracture and failure of concrete under simple and combined stress. Special concrete and processes including light weight, heavy, fire resistant, refractory polymer. Methods of testing. Evaluation of concrete quality in structure. Case studies of actual site investigations.

CVE 835: PLASTICITY IN STEEL STRUCTURES (2 UNITS)

Incremental collapse and alternating plasticity of beams and plane frames. Grillages in bending only. Yield criteria, flow rules, normality plates under normal loading only, plates under combined in-plane and normal loading. Torsional behaviour of thin-walled members of open and closed cross section. Pure and restrained torsion, shear, centres. Element behaviour and design.

An introduction to the design members under new code provisions covering tension members, axially loaded compression members, beams and columns with biaxial bending and lateral torsion buckling. Inelastic stability concepts in modern design, compact section provisions, imperfection sensitivity, moment relaxation, inelastic lateral torsion buckling provisions and the design of bracing. Beam-column behavior and design under sway and no-sway conditions.

CVE 837: CONNECTIONS AND PLATED STRUCTURES (3 UNITS)

Introduction to principles of connection design. Bolts, rivets, types and technology. Behavior of individual bolts and rivets, static behavior and design of bolted/riveted connections. Fatigue in bolted and riveted connections. Welds behavior of unit welds, behaviour and design of welded connections. Design of other components within the connection. Design of tubular connections. Interaction of connection and structural behaviour, e.g. simple, semi-rigid and rigid frames. Plant stress; shear lag, stress diffusion, stress concentrations. Small deflections theory for orthotropic plates, orthotropic plate rigidities for stiffened plates. Linacarised theory for combined loading. Large deflection theory. Critical buckling of plates in compression and/or shear; post-buckling pf perfect plates. Buckling of plates geometrically imperfect plates; effect of residual stress. Strength of imperfect plates in compression, and/or shear. Plate assemblages and interacting plate buckling modes; bases for slenderness limitations for stiffeners; bases for design of compression flanges, webs and diaphragms in box girders. Design of plated members. Plate and box girders.

CVE 839: DETERIORATION AND PRESERVATION OF TIMBERS (3 UNITS)

Types of degrade and defects: fungal and insect attack, natural degrade and defects, conversion and seasoning. Specification: species and use equilibrium moisture content and variation. Protection against:

weather, condensation, rising damp. Fire effect and hazard/; fire resistance and fire protective construction. Termite resistant construction: poisoning, treatment and design considerations. Earthquake and hurricane resistant construction. Protection by treatment: uses of preservative treatment, surface finishes. Durability of timber: natural durability, effect of drying, toxic extractives, fungal and insect attack: moulds, stains, soft rot, brown and white rots, wood-boring insects, termites and marine bores. The process of fungal decay: spectrum of interaction between fungi and wood, association and succession of fungi. Wood preservation chemicals: tar oils, water-borne types, organic solvents. Application of preservatives; surface treatments, impregnation by vacuum and pressure, diffusion processes.

CVE 841: SPECIAL STEEL STRUCTURES AND PRODUCTS(3 UNITS)

Structural forms, special steel structures such as: masts and towers; orthotropic bridges decks; tubular structures; space frames; cable stayed bridges; cable roofs; bins, hoppers and tanks; curved bridges; very tall building; offshore structures. Types and technology of steel structural steel.

CVE 840: SEMINAR (1 UNIT)

Introduction to the Scientific Literature. Students undertake the study of make up or Technical Paper in Civil Engineering. Many papers are read, summarized and presented to the class. Finally, one or two topical papers are written and presented by each student for assessment.

CVE 842: THESIS (6 UNITS)

Theses proposals are written, presented and defended before the Post Graduate Board. Final Thesis is presented in acceptable format and defended before an external examiner.

1.5.18 M.Eng. Water Resources or Environmental Health Engineering

First Year: First Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 801	Numerical Methods	3	
2	CVE 803	Applied Hydraulics	2	
3	CVE 805	Engineering Hydrology	2	
4	CVE 807	Water Law, Management and Economics	2	
5	CVE 809	Principles of Water Quality	3	
6	CVE 811	Waste Water Treatment & Disposal	3	
7	CVE 813	Seminar	1	
		Total	**16**	

First Year Second Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 802	Hydrodynamics	2	
2	CVE 804	Advanced Applied Hydraulics	2	
3	CVE 806	Environmental Impact Assessment	2	
4	CVE 808	Dams Design and Reservoir Operations	2	
5	CVE 810	Water Treatment, Supply, Planning & Management	2	
6	CVE 812	Surface Water Hydrology	2	
7	CVE 814	Catchment Modeling	2	
8	CVE 816	Seminar	1	
		Total	**15**	

Electives (Pick At Least 6 Units)

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 815	Aspects of Occupational	2	

		Health and Safety		
2	CVE 817	Hazardous waste Management	2	
3	CVE 819	Small Watershed System Design	2	
4	CVE 821	Waste Resource Infrastructure	2	
5	CVE 823	Applied Statistics	2	
6	CVE 825	Systems Analysis in Water Resource Management	2	
		Total	**12**	

Second Year

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 818	Seminar	1	
2	CVE 820	Thesis	12	
		Total	**13**	

1.5.19 Course description:

CVE801: NUMERICAL METHODS (3 UNITS)

Accuracy in numerical, calculation, errors, significant figures, calculation of sine, cos, and exponential series by Taylor's expansion. Interpolation; Newton's forward, backward and forward difference formulae. Numerical differentiation and integration; Trapezidal and Sampson rules, automatic selection of interval size, Newton cotes formulae. Solutions of algebraic and transcendental equations; graphical, bisection interaction. Newton, Raphson solution of simultaneous equations ;(Gauss and Gauss-siedel); Eingenvalues and Eingeenvectors; Numerical solution of ordinary differential equations. Methods of Euler, Picard, Taylor's and runge-Kuta Predictor-corrector. Methods for solving ordinary differential equations, Introduction to partial differentiation.

CVE 803: ADVANCED APPLIED HYDRAULICS (3 UNITS)
Advanced hydraulics of open channels families of water surface profiles: supercritical flow, unsteady flow in open channels, waves, surges, methods of characteristics. Fluidy and non-Newtonian flows. Rotodynamic machines and pumps basic equations; similarity laws specific sppeds. Cavitations theory and applications. Effects on hydraulic systems, measurement, control and elimination, hydraulic structures. Design of water transmission and energy dissipating structure. Coastal Engineering- Basic wave theories, forces, tide analysis, coastal processes. Sediment transports in open channels, turbulence. Dispersion equation of pollutions. Regime concept. Types of sediments, model.

CVE 805: ENGINEERING HYDROLOGY (3 UNITS)
Atmosphere circulation; sources of rainfall. Hydrological cycle. Measurement and analysis of rainfall data. In filtration and soil moisture measurement. Stream flow gauging methods hydrograph analysis; instrumentation. Aquifers; types and properties; flow nets; hydraulics of wells pumping test analysis of ground water follows.

CVE 807: WATER LAW, MANAGEMENT AND ECONOMICS (2 UNITS)
Legislation relating to water resources. National water policy. Management of water Resources. Trans Boundary Waters. River Authorities, their organization and responsibilities. Water boards/utilities, their organization and function; Contract and land acquisition laws for water resources development. Planning for water Resources development for different uses. Balancing water supply and demand. Project formulation. Multiple purpose projects. Systems analysis. Cost allocation. Economics of water resources development.

CVE 809: PRINCIPLES OF WATER QUALITY (3 UNITS)

Physical, chemical and microbiological aspects of water resources planning. Surface and groundwater quality. Principles of chemical analysis of water. Instrumental procedures for quality assessment. Standards for water for different purposes. Refractive substances in water and their affects on water usage. Microbiology of biological water treatment processes

CVE 811: WASTEWATER TREATMENT AND DISPOSAL (2 UNITS)

Basic Wastewater treatment system and schemes for municipalities of different sizes. Factors affecting the selection of treatment scheme. Plant layout and sizes. Factors affecting the selection of treatment scheme. Plant layout and hydraulics profiles. Unit operation and processes in wastewater treatment and sludge handling (domestic, municipal industrial). Advanced theory and design of physical, chemical, biological treatment facilities equalization, lamella sedimentation screening and micro screening aerobic and anaerobic filters. (biological). Wastewater treatment in hot climates; Stabilization ponds, aerated lagoons, oxidation ditches rotating biological contractors, biological fluidized bed filter, etc, sludge: anaerobic digestion, thickening vacuum centrifuging, pressure dewatering air drying and heat treat. Incineration and wet oxidation of sludge. Tertiary treatment of wastewater. Nutrients removal (phosphorus, nitrogen and suspended solids)

Design principle for separate, combined and semi-separate sewers. Estimation of dry weather and storm water flow for rainfall of difference duration and intensity. Lloyd-Davies method. Area- time diagram and tangent methods. Sizing and construction of sewers pipes. Manhole chambers and storm water over flows. Pumping stations. Screens and inverted siphons. Corrosion in sewers. Sewer maintenance.

CVE 802: HYDRODYNAMIES (2 UNITS)

Eulers equations Narvier Stokes equations. Effect of viscosity. Laplace equation. Waves (deep –Water, short and long tidal waves). Dynamics of fluids. Sediment transport in open channels. Bedload and suspended load. Duboys-type equations. Einsteinsbedload equation. The total load. Canals in regime. Meandering of rivers. Measurements of Sediment River and channel models.

CVE 804: ADVANCED APPLIED HYDRAULICS (3 UNITS)

Advanced hydraulics of open channels families of water surface profiles: supercritical flow, unsteady flow in open channels, waves, surges, methods of characteristics. Fluidy and non-Newtonian flows. Rotodynamic machines and pumps basic equations; similarity laws specific speeds. Cavitation theory and applications. Effect on hydraulic systems, measurement, control and elimination, hydraulic structure. Design of water transmission and energy dissipating structure. Coastal Engineering-Basic wave theories, forces, tide analysis coastal processes. Sediment transports in open channels turbulence. Dispersion equation of pollutions. Regime concept. Types of sediments, model.

CVE 806 ENVIRONMENTAL IMPACT ASSESSMENT (2 UNITS)

Concept of environmental consequence of developmental projects. Methods impact analysis. Physical sociological, legal, economic, environmental at public health implications of human activities. Effects of change environments on man. Example of impact assessment (EIA, SIA etc.) with particular reference to developing countries. Role of environmental engineering in preventing or reducing environmental stress. Planning and policy, administration and organization of natural resources development and public health. Land use planning and landscape design.

CVE 808: DAMS DESIGNS AND RESERVOIR OPERATIONS (2 UNITS)

Types of dams. Investigation of dam sites. Requirements for stability of gravity dams. Design procedure for gravity dams. General principles for designing rock and earth fill dams. Seepage through dams. Seepage line in earth dams of composite cross-section. Effect of drainage on line seepage. Foundations types and treatment. Slope protection. Typical design of embankment dams, and methods of construction. Hydropower plants. Types of plants, penstock, tunnels and water turbines. Physical characteristics and capacity of reservoirs. Sedimentation. Reservoir capacity for given yields. Site selection for river reservoirs. Wind set up and waves on reservoirs. Flood routing through reservoirs. Flood mitigation, direct supply and regulating reservoirs. Pumped storage reservoirs. Conjective use schemes. Control rules. Simulation-Evaluation criteria for comparing alternatives. Seasonal effects and correlations. Spillways, gates and outlet works. Overflow (egee), chute, side-channel, siphon and shaft spillways. Spillways crest gates. Vertical lift, radial, rolling, drum gates and high pressure outlets. Gates and values. Noodles values. Protection against scour below dams. Basins and energy dissipaters. Hydraulic model studies. Fish ways at dams.

CVE 810: WATER TREATMENT AND SUPPLY (2 UNITS)

Basic concepts for the design of water supply systems for domestic; municipal, industrial use and rural areas. Design period population, flow rates for water supply systems. Factors affecting water consumption and variation in demand. Fire demand and coincidental draft. Design of water distribution systems. Distribution components. Methods of analyses for optional distribution network design. Estimating storage requirements. Types of distribution reservoirs and design parameters. Design of pumping stations. Pumping schedules. Management, operation maintenance of water supply facilities.

Specific water treatment processes for boilers cooling systems and other industrial supplies cold and hot softening, demineralization, aeration, deaeration, degasification and decontaminating of steam. Corrosion of pipes and boilers silica. Removal of boiler scales.

CVE 812: SURFACE WATER HYDROLOGY (2 UNITS)

Meteorology and hydrometry. Precipitation and run-off. Stream flow measurements. Evapotranspiration catchments flood-producing characteristics. Drought occurrence. Empirical methods and rational formula of drought prediction. Unit hydrograph, S-cures. Instantaneous unit hydrograph. The Nash model. Hydrograph, forecasting and data fitting techniques. Probable maximum precipitation and probable maximum flood methods. Methods of routing floods through open channels and reservoirs, simplified hydraulic routing methods. Statistical and stochastic hydrology.

CVE 814 CATCHMENTS MODELING (2 UNITS)

Hydrologic, mathematical/modeling techniques. Black box models. Rainfall run-off models. Deterministic and water budgeting models. Parameter optimization; modeling of component processes and channel flow. Models. Other long memory models.

CVE 815: ASPECTS OF OCCUPATIONAL HEALTH AND SAFETY (2 UNITS)

Relationship between worker health and safety and the work environment. Analysis of industrial health and safety problems. Practices likely to create hazards to the workforce. Safety regulation in work environments. Prevention of industrial and occupational hazards and accidents. Emergency management and first-aid.

CVE 817: HAZARDOUS WASTE MANAGEMENT (2 UNITS)
Characterization, treatment and final disposal of hazardous wastes; relevant regulation and legislation for hazardous wastes management; hazardous waste minimization, Hazardous waste treatment options: Hospital, Industrial, etc. Clean – up of contaminated sites. Case studies.

CVE 819: SMALL WATERSHED SYSTEMS DESIGN (2 UNITS)
Hydrologic design of water management systems. Hydrologic design and the production of agricultural and other biological materials. Analysis and design of composite systems for watersheds.

CVE 821: WASTE RESOURCES INFRASTRUCTURE (2 UNITS)
Case history/studies of local infrastructure use for controlling and utilizing water e.g. hydro-electric projects, development of alluvial fans and floodplains. Management of transportation corridors with emphasis on engineering and environment aspects.

CVE 823: APPLIED STATISTICS (2 UNITS)
Theory of probability and statistics. Principle of maximum entrop and its use in the specification of prior probabilities. Baye's theorem. Confidence internals regression and special applications relevant to engineering.

CVE 825: SYSTEMS ANALYSIS IN WATER RESOURCES MANAGEMENT (2 UNITS)
The optimal management of water resources system requires that the natural distribution of water resources be subjected to structural and non-structural measure such that the objectives of management are achieve in optimal manner. Systems analysis provides a framework within which this can be achieved. The basic principle of this course is resource management.

Optimization techniques for systems analysis. Application of systems analysis to problems of design and operation of water resources systems. Mathematical modeling of complex water resources systems and its decision making in water resources management.

1.6.0 Doctor of Philosophy Degree Programmes (Ph.D)

The department offers a Ph.D Degree programmes in Civil Engineering.

1.6.1 Philosophy

The philosophy of postgraduate programmes in Engineering is to develop highly skilled professionals for the public, private and international organizations, as well as for teaching and research in Tertiary Institutions and for global competitiveness.

1.6.2 Aim and Objectives

The aim and objectives of the postgraduate programmes in Engineering are geared at:

- Providing students with knowledge and competitive skills to enhance their performance and to enable them to assume broader responsibilities in the rapidly changing environment in the context of the global and contemporary knowledge economy;
- Producing high level practitioners who are capable of applying appropriate engineering principles and techniques for solving problems in the local, national and international environment viz-a-viz teaching, research and industry.
- Producing socially responsive and functional engineers capable of positively driving the engine of Nigeria's economy through accelerated technology development.

- Providing opportunity for University graduates in relevant science disciplines and HND holders to convert and aspire to higher degrees in Engineering; and
- Producing Engineers in ICT having entrepreneurial skills and leadership qualities; including sound professional ethics.
- The Ph.D degree in all disciplines of Civil Engineering is to develop the engineer to the highest level possible for decision making and particularly research. It trains the students to consider and handle complex problems and also initiate students into research.

1.6.3 Admission Requirements

The criteria for admission into the Postgraduate Engineering programmes are as follows;

Basic Requirements

All candidates must have five Credit passes including English, Mathematics, Physics and Chemistry O'Level.

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Doctor of Philosophy (Ph.D) Degree

A candidate who holds a Masters degree, with a minimum CGPA of 3.50 on a 5-point scale or an average of 60%, which includes coursework and research thesis in a relevant Engineering discipline, from a recognized university may be admitted provide the university matriculation requirement is satisfied

1.6.4 Mandatory Duration of Programmes

Ph.D Programme

i. Full-time; A minimum of six (6) semesters and a maximum of twelve (12) semesters

ii. Part-time; A minimum of eight (8) semesters and a maximum of sixteen(16) semesters.

1.6.5 Requirements for Student Supervision

Subject to individual University peculiarities, requirements for supervision of postgraduate students shall be as follows;

a. At least two [2] supervisors for each postgraduate on Ph.D programme shall be appointed.
b. The Ph.D, supervisors must not be of a rank lower than senior lecturer and must not be registered postgraduate students.
c. A supervisor shall guide a student in his/her studies and the department shall keep a record of candidate's progress and submit a regular progress report through the Dean to Board of postgraduate studies.
d. A supervisor may be changed where and when necessary subject to the approval of the board of postgraduate studies.

1.6.6 Examinations

Course Work

a. For all postgraduate coursework, the minimum pass score shall be 50%; continuous assessment shall constitute not less than 30% of the examination for each course;
b. Any student who fails in any course, shall repeat such a course; and
c. Any student whose Cumulative Grade Point Average [CGPA] falls below 2.50 at the end of 2 consecutive semesters shall be required to withdraw from the programme.

The scoring and grading of courses shall be as follows;

Marks	**Letter Grades**	**Grade Points**
70 and above	A	5
60-69	B	4
50-59	C	3
0-49	F	0

Thesis or Dissertation

A panel of examiners shall be composed to orally assess a thesis or dissertation according to the university regulations, but the examination shall at least be guided by the following;

Ph.D Thesis: The minimum composition of the examination panel shall comprise:

i. External Examiner;
ii. Head of Department who must be a Ph.D holder;
iii. Supervisor;
iv. Co-supervisor;
v. One other member of the Department who is not below the rank of Senior Lecturer or an academic staff from a related Department within the Faculty who must be a Ph.D holder and
vi. A representative of the board of the school of Postgraduate (PG) studies.

1.6.7 Graduation

For the PG programmes, classification of certificates shall be based on the following:

CGPA	4.50	-	5.00----------	Distinction
	3.50	-	4.49----------	Upper Credit
	2.50	-	3.49----------	Lower Credit
	1.50	-	2.49----------	Pass

1.6.8 Academic Standards

Academic Regulations

a. **Academic Session**

An academic session consists of two semesters. Each semester normally comprises 15 weeks of teaching and two weeks of examinations.

b. **Modular System**

All engineering programmes shall be run on a modular system, commonly refers to as course Unit system. All courses should therefore be sub-divided into more or less

self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Unit weights should be attached to each course.

c. **Definition of Units or Unit:**

Units are loads attached to a course. One Unit load is equivalent to one hour per week per semester of 15 weeks of lectures or two hours of tutorials or three hours per week of term paper work or laboratory practical per semester of 15 weeks.

1.6.9 Programme Requirements

a. **Registration Procedure**

Students shall normally complete registration for courses for the semester not later than two weeks after start of the semester. A student cannot withdraw from a course after a third of it has been delivered without permission, according to the regulation of the university. A student who withdraws after this time or who fails to sit for the final examination without reason acceptable to the Senate shall be deemed to have failed that course.

b. Student Academics Status

A student's academic status shall be determined on the basis of his\her performance at the end of the semester examinations.

c. **Good Standing and Probation**

To be in good standing, a student must in each semester have a CumulativeGrade Point Average [CGPA] of not less than 2.50. A student who is not ingood academic standing shall be deemed to be on probation.

1.6.10 Withdrawal

A candidate whose CGPA is below 2.50 at the end of 2 consecutive Semesters shall be required to withdraw from the university.

1.6.11 Attendance

In order to be eligible for examination in a particular taught course, a student shall have attended a minimum of 75% of the total periods of formal instructions delivered for the course.

1.6.12 Course Evaluation

a. **Attainment Levels**

In Engineering programmes, assessment of students' should be based on a combination of performance in some or all of the following areas:

- Examinations;
- Continuous assessment;
- Oral presentations and Seminars and problem solving exercise;
- Assignments;
- Group project works; and
- Thesis\Dissertations.

b. Continuous Assessment

Continuous assessment shall be done through essays, test, term papers tutorial exercises, quizzes and home works. Scores from continuous assessment shall constitute at least 30% of the final marks for courses which are primarily theoretical.

c. External Examiner System

The external examiner system shall be used in the final year of the graduate programme to assess final year

courses and projects, and to certify the overall performance of the graduating student, as well as the quality of facilities and teaching.

1.6.13 General Course Requirements

Courses specified for engineering disciplines are just suggestion of common courses in the various fields of engineering.

Ph.D Requirements

For Ph.D programmes, candidates shall be required to have taken the core\compulsory

Courses prescribed for the M.Sc.\M.Eng. as prerequisites. This is in addition to the minimum 21 units which include research and seminars prescribed for the Ph.D.

1.6.14 Area of Specialization:

The programme provides the opportunity for students in any of the following stress areas: structures and water resources.

1.6.15 Doctor of Philosophy (Ph.D) Programme in Structural Engineering:

First Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 901	Advanced Theory of Elasticity	3	
2	CVE 903	Advanced Theory of Plates	3	
3	CVE 905	Energy Principles in Structural Mechanics	3	
		Total	**9**	

Second Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 902	Advanced Theory of Shell	3	
2	CVE 904	Stability of Structures	3	
3	CVE 906	Dynamics behaviour of Structures	3	
		Total	**9**	

Other Semesters

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 908	Seminar	2	
2	CVE 900	Ph.D Theses	6	
		Total	**8**	

1.6.16 Course Descriptions

CVE 901: ADVANCED THEORY OF ELASTICITY (3 UNITS)
Analysis of stress, strain and stress-strain relations, two dimensional problems in Elasticity, Bending of beams, Beams on Elastic foundations, Energy methods and Elastic stability.

CVE 903: ADVANCED THEORY OF PLATES
(3UNITS) Energy and vibrational Methods for solution of lateral Deflections, Introduction and basic concepts, Ritz's method, Galerkin's method and its variant by Vlasov, Gridwork and framework methods, Basic concepts, Introduction to structural dynamics, differential equations of lateral Motion, free flexural vibration of plates, Energy methods for determination of natural frequencies, fundamental of stability analysis.

CVE 905: ENERGY PRINCIPLES IN STRUCTURAL MECHANICS (3UNITS)
Classification of structures, classification of loads, Analysis of stress, Energy principles, Strain energy, Virtual work, Complementary virtual work, Reciprocal Theorems, Principle of Minimum Complementary Energy, Castigliano's theorem, Rayleigh-Ritz Method, Statically Indeterminate structures, displacement method, force method, Matrix method, Thermal stresses and displacements in structures.

CVE 902: ADVANCED THEORY OF SHELL (3 UNITS)
Membrane Hypothesis and theory of bending Stresses in long

shell Structures, Cylindrical shells, shells of revolution, translation shells and domes. Stability and vibrations of shells.

CVE 904 : STABILITY OF STRUCTURES (3 UNITS)
Buckling of plastic and inelastic columns, plates and frames, torsion and lateral buckling. Various methods of solutions.

CVE 906: DYNAMIC BEHAVIOUR OF STRUCTURES (3UNITS)
Structures with one degree of freedom, structures with many degrees of freedom, continuous structures.

CVE 928: Ph. D THESES (6 UNITS)

1.6.17 Doctor of Philosophy (Ph.D) Programme in Water Resources Engineering:

First Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 921	Systems Analysis in Water Resources Management	3	
2	CVE 923	Engineering Sustainability	3	
3	CVE 925	Probability and Reliability Theory	3	
4	CVE 927	Water Power Engineering	3	
5	CVE 929	Environmental Impact Assessment	3	
		Total	**15**	

Second Semester

S/N	Course Code	Courses	Credit Load	Lecturer
1	CVE 922	Library Seminar	2	
2	CVE 924	Research Project (Seminar)	12	
3	CVE 926	Renewable Energy System	2	
4	CVE 928	Project	6	
		Total	**22**	

Third Semester
Proposal- School of Post Graduate Studies (SPGS) Candidacy Defence. (Apply to SPGS – 2 weeks notice to be given)

Fourth Semester
Research
Ph.D Comprehensive Research Work

Fifth Semester
Internal Defence – at the Department (SPGS and Dean Faculty of Engineering to be notified)

Sixth Semester
External Defence

1.6.18 Course Description

CVE 921: PUBLIC SYSTEMS ANALYSIS (3 UNITS)

Concept of system structure and organization. The system of holistic approach as a methodology for making decisions and allocating resources. Analysis by means of objectives, alternative. Modes, criteria and feedback. Extension and elaboration of systems analysis techniques, including their application to industry, input-output structures, human behaviour in organization and military situation. Linear and non-linear systems analysis; dynamics and stability of systems. Introduction to optimization methods and systems simulation techniques.

CVE 923: ENGINEERING SUSTAINABILITY (3 UNITS)

(a) Understanding Complex Systems

Environmental Management Systems, Stakeholder Dialogue, impact Assessment, supply chain management, sustainability indicators, Corporate Social Responsibility, Technical Innovation, Life Cycle Analysis, Legal Directives, Ecology Foot printing, Millennium Development Goals, Global Poverty, Justice through participation, Efficient Co-ordinated infrastructure, maintenance of natural capital, Holistic Financial Accountability.

(b) Environmental Management

The spectrum of technical, economic, political, administrative and social forces influencing the quality of our environment and the use of our resources. Review of governmental and industrial programmes to combat pollution of air, land and water, review of existing and pending legislation environmental and related energy matters, theoretic aspects environmental impact; institutional designs; procedures for promotion public participation.

CVE 925 PROBABILITY AND RELIABILITY THEORY (3 UNITS)

(a) Discrete Systems Simulation

Monte Cario simulation of discrete stochastic models,. Modeling complex operation research systems. Simulation languages, random numbers and deviate generation. Statistical design and analysis of simulation experiments validation of simulation models. Applications including inventory, scheduling and computer models.

(b) Reliability Theory

Introducing the mathematical and Statistical theories of reliability Mathematical theory; theory of coherent structures, association of random variable, stochastic characterization of wear, total positivity, prevention theorems and bounds and inequalities, statistical theory, probabilistic derivation of failure models, censored, truncated and sequential life testing procedures using Bayesian techniques, commonly used military plans recent developments in analysis of failure data. Multivariate survival, shock models and reliability theory for multistate components.

CVE 926: RENEWABLE ENERGY SYSTEM

Concept of renewable energy, Sources of renewable energy, its merits and demerits, Characteristics of renewable energy, other forms of energy, clean and green energy, Non-renewable energy sources, Renewable energy technologies, Energy efficiency, prospects of renewable energy.

CVE 927: WATER POWER ENGINEERING

Classification of hydro power plants, Advantages of hydro power, selection of site for hydro power plant, essential data for power studies, Requirement of water for hydel power, Definition of Thermal power, hydro-thermal mix, Hydro Vs thermal power, Components of hydro power plant, Design of hydel Channel, Components of a hydro power scheme.

CVE 929: ENVIRONMENTAL IMPACT ASSESSMENT

Concept of environmental consequence of development projects. Methods of impact analysis. Physical sociological, legal, economic, environmental and public health implications of human activities. Effects of changed environments on man. Examples of impact assessment (EIA, SIA, etc) with particular reference to developing countries. Role of environmental engineering in preventing or reducing environmental stress. Planning and policy, administration and organization of natural resources development and public health. Land use planning and landscape design.

Chapter 2

2.0 Staffing

Staffing includes academic, non –teaching and administrative staff.

2.1 Academic Staff

S/N	Name of Lecturers	Status	Qualifications	Courses Taken
1	Prof. C. Obika	Full time	Ph.D	ENG101,
2	Prof. B. U. Anyata	Adjunct	Ph.D	CVE 805, CVE 801, CVE 921, CVE 923
3	Prof. O. O. Ugwu	Adjunct	Ph.D	CVE 333, CVE 713
4	Prof. E. O. Eze	Adjunct	Ph.D	CVE 441, CVE 710, CVE 724
5	Prof. J. C. Ezeh	Adjunct	Ph.D	CVE 411, CVE 827
6	Prof. F. O. Okafor	Adjunct	Ph.D	CVE 552, CVE 716,
7	Asso. Prof. C. A. Chidolue	Adjunct	Ph.D	CVE 341, CVE 342, CVE 314
8	Asso.Prof. B. Dike	Adjunct	Ph.D	CVE 808, CVE 712
9	Asso.Prof.B. Okoro	Adjunct	Ph.D	CVE 810, CVE 721, CVE 992
10	Engr.Dr.I.E. Umeonyiagu	Full time Senior Lecturer	Ph.D	CVE 513, CVE 511, CVE 514, CVE 411, ENG 241,
11	Dr. L. C. Eme	Full time Senior Lecturer	Ph.D	ENG 232, CVE 421, CVE 543, CVE 321, CVE 544
12	Engr.S.C.	Full time	M.Eng.	CVE 272, CVE

	Ezekafor	Senior Lecturer		323, CVE 523, CVE 524
13	Engr.Dave Chukwujekwu	Full time Senior Lecturer	M.Eng.	ENG 305, CVE 541, CVE 542
14	Dr.Akaolisa Ezeagu	Adjunct Senior Lecturer	Ph.D	CVE 311, CVE 512, CVE 413
15	Arc.Dr.K.Ezeji	Full time Senior Lecturer	Ph.D	CVE 114, CVE 213, CVE 214
16	Dr. K. Babayemi	Full time Senior Lecturer	Ph.D	ENG 261, ENG 232
17	Engr.Dr.Nwobi Okoye	Full time Senior Lecturer	Ph.D	ENG 301, ENG 302
18	Engr. Dr. J.I. Iloh	Full time Senior Lecturer	Ph.D	ENG 302, ENG 401
18	Engr.Dr.E.N. Ikezue	Full time Senior Lecturer	Ph.D	ENG 401
19	Engr.Dr.C.C. Ohia	Full time Senior Lecturer	Ph.D	ENG 106, ENG 231
19	Engr.P.C.K.Okika	Full time Lecturer 1	M.Eng	CVE 531, CVE 532, CVE 431
20	Engr.Emmanuel Nwankwo	Full time Lecturer 1	M.Eng	ENG 201, ENG 202
21	Sur.I.C. Ezeomedo	Full time Lecturer 11	M.Sc	CVE 252, CVE 352, CVE 451
22	Mrs.N.C. Mwuowuba	Full time Assistant Lecturer	M.Eng	CVE 521, CVE 522, CVE 423

23	Mr.Ikechukwu Chigbo	Full time Assistant Lecturer	M.Eng	CVE 332, CVE 333
24	Mr.S.C.Ezemenike	Full time Assistant Lecturer	M.Eng	CVE 453, CVE 725
25	Mr. E.I. Ogunjiofor	Full time Graduate Assistant Lecturer	B.Eng	CVE 312, ENG 241, CVE 262,

2.2 Non-Teaching Staff (Technical)

Name of staff	**Rank/Desig-nation Salary Scale, date of first appointment**	**Qualification, dates obtained and specialization, membership of professional association and number of publications**	**Post Qualification work/Teaching experience and date, post held and the organization**	**Course/ subjects taught**	**Teaching load/ lecture hours/ week**
Engr.Uzuegbunam R.U.	Assistant Chief Laboratory Technologist CONUASS 12 11/12/2008	Assist Chief Technologist COOU 2009 to date Principal technologist COOU, 2104 Director of works, COOU January 2012-December 2012 Senior project management service engineer Shell petroleum development company,	M.Eng.(water resources and environmental engineering) COOU 2016 M.B.A. (project management technology) B.Sc. (civil Engineering) 1984-1989 FUTO MBA (Project Management Technology FUTO 1991-1993	CVE 342, CVE311 CVE 411, CVE 541	12

		PortHarcourt 2002-2009 Senior Quality Assurance/Quantity Control Engineer Adadrill Nig. Ltd, PortHArcourt 1993-2002 Assistant Project Manager Quants Service Group, Owerri 1993-1992 Civil Engineer, Alcon Nigeria Ltd, Port Harcourt, 1991-1992 Sita Engineer, PoatsEnginerin gCo.LtdAkure. 1990-1991. Industrial attachee Federal Mortage Bank of Nig.Ltd, Owerri. 1988-1989.S NSE (1998) MAPM, MCOREN (2000) MNISE, SMNIS Conference Papers five	National Diploma in Civil Engineering Technology FUTO 1983-1984		
Engr.	Chief	B.ENG.	Chief	ENG	9

B.C.J. Obieli	Technologist CONUASS 7^4 14/7/2008	(Mechanical Engineering 1968-1973 COREN (R.4350) 1991 NSE- 1989	technologist, Mechanical Engineering, COOU, 2008-date	122, ENG 212, ENG 222.	
Peter .C. Obi	Assistant Chief Technologist 13/1/2005 CONUASS 9	Higher Diploma Institute of Management and technology Enugu State 1981	Asst. Mechanical Premier Breweries limited 1982 Utilities Engineering Olympic Drink Company LTD Onitsha 1988 Technologist COOU 2005 till date Senior Admin and Technical staff COOU, 2007, Senior Technologist COOU, 2008 Principal Technologist COOU, 2011 Assistant Chief Technologist COOU 2014,	ENG 122 ENG 212 ENG 222	9
Mrs. Umeaku	Technologist 1	Technology 1, COOU, Senior Technology 1 COOU	ND(Sc. Tech), 1982. HND (Sc. Tech), 1985. PGD(Microbiology), 1998 M.B.A 1994. Federal University of Technology , Owerri. B.Eng 1989, FUTO	CVE 342	3
Ngukor	Senior		HND(civil	CVE211	3

A.N.I	Technologist		Engineering), 1978		
Ugochukwu R.	Technology		ND(Civil Engr),1997	CVE 311	3
Uba Obumkelu C.	Technologist		B. Tech. (Civil Engr.) 1985. University of Science and Technology PortHarcourt.		
IfeanyiOguaju Steven	Technician Grade 1		City and Guild Certificate. 1982	ENG 271	3
Mrs. Ubajekwe Chikodili	Principal Technologist			CVE 521, CVE 522	6

2.3 Administrative Support Staff

Name of Staff	Rank/Designation Salary Scale and Date of First Appointment	Qualifications and Date obtained	Post Qualification Work Experience
Ogbue Nkendilim .H.	Senior Clerical officer 13/11/2006 Conunass 8^5	NCE Anambra State College of Education Nsugbe 1997	Senior Clerical officer Library COOU Senior Executive Officer COOU Senior Clerical Officer Student Affair COOU
OgechukwuOkoro	Senior Clerical Officer	HND IMT Enugu 2014	Senior Clerical officer Library

			COOU Senior Executive Officer COOU Senior Clerical Officer Student Affair COOU
Agbasiere Chukwunonso C.	Clerical Officer Conunass 5[7],	NECO 2002	Clerical Officer 2007 Dept. of Anatomy. Senior Clerical Officer Faculty of Engineering 2011 COOU. Assistant Chief Clerical Officer, Biological Science and Industrial Chemistry and Civil Engineering till data
Okafor Patience Ugochi	Computer Operator , Conunass 4[7], 1/12/2007	Diploma in Computer - 2004 FSLC- 1995 SSCE 2003, NECO 2008	Computer Operator II Library COOU. Computer operator III Chemical Engineering 2009 COOU. Computer operator Exams Units IV 2013 COOU.

			Computer Operator Civil Engineering Dept. IV 2016 till data COOU.

Chapter 3

3.0 Overall Management of Programme

The overall management/administration of the programme is as follows:

(a) Organization Structure (a chart is attached)

The highlight of administrative body in the department is the Departmental Board. Membership of the Board comprises the Head of Department as its chairman, all academic staff and the senior technical staff who are sectional heads. While the Board formulates policies that guide the overall governance of the Department, the Head of Department is responsible for the day to day running of the Department and reports periodically to the Board. The laboratories are divided into sections with the most senior technical staff as sectional heads. These heads are responsible to the Head of Department.

(b) How staff are involved in the decision-making process and in general administration.

At the beginning of each session, the Head of Department nominates members into the various Departmental Committees that assist in the running of the Department. These committees help to carry staff along in the general administration of the Department. Some of these committees and their responsibilities are listed below:

(i) Examinations Committee:

The Committee consists of six senior academic staff and the external examiner with the Head of Department as chairman.The Committee is saddled with the responsibility of vetting the examination questions submitted by the various lecturers. The Examination's officer takes the responsibility for the production and proof-reading of the

question papers, examination time tabling and scheduling of examination invigilators.

(ii) Projects Coordinator:

Engr. Dr. E.I. Umeonyiagu is an academic staff whose duty is to assign final year students to academic staff for project supervision. He coordinates the project defense and ensures that each student's project meets the format and standard set out by the Department.

(iii) SIWES Coordinator:

Dr. L. C. Eme is the academic staff charged with the responsibility of arranging placement of our 400 level students on the Students' Industrial Works Experience Scheme (SIWES). He collects the students log books and their technical reports at the end of each Industrial attachment and works out the grade for each participating student through a Departmental SIWES defense exercise.

(iv) National Association of Civil Engineering Students (NACES) Adviser:

This is an academic staff charged with the responsibility of guiding the undergraduate students association, NACES. Engr. P.C.K. Okika is the staff- link between the students and the Head of Department in the organization of activities of the students such as the NACES week, the engineering week, academic excursions to local industries within the geopolitical zone.

3.1 Students Welfare.

a. Handling of academic grievances.

The University has set out procedures for handling academic grievances of students, and these are listed in the academic regulations of the University. In the department, the disciplinary Committee decides and adopts a method that will be fair to all concerned in their grievances.

b. Students' Academic Advising:

All teaching staff are involved in academic advising. Each level of students is assigned principal and assistant course advisers by the Head of Department. These academic staff remain the student's course adviser, as long as they are students in the Department. Some of the functions of the advisers include:

(i) Ensuring effective enrolment of the students during registration.

(ii) Checking the academic loads of the students with regards to the number of credit hours to be carried per semester.

(iii) Counseling students as the needs arise.

The current academic advisers of the Department are as follows:

(i) 100L Engr. P.C.K Okika (ii) 200L Dr. L.C. Eme,

(iii) 300L Mrs. N. C Mmuowuba(iv) 400L Engr. Dr. E.I Umeonyiagu

(v) 500L Engr. S. C. Ezekafor

3.2 Examination Board:

(a) Setting, conduct, evaluation schemes, moderation schemes – Internal and external for final year examinations and the issuance of results.An internal moderation of

examination questions and model solution for other classes other than the final year papers is done by the Examination Board. The external moderator is responsible for the vetting of the final year questions and solutions. The moderated papers return to the Head of Department who together with the examination officer will arrange for the typing.Each lecturer grades his scripts and returns same to the Head of Department, for a second moderation by the Board. The external examiner will in turn go through the graded scripts and unbound copies of the students project reports on arrival at the University. The results of the final year students are presented to the Senate for consideration and approval, after which they are formally released.

3.3 Academic Atmosphere

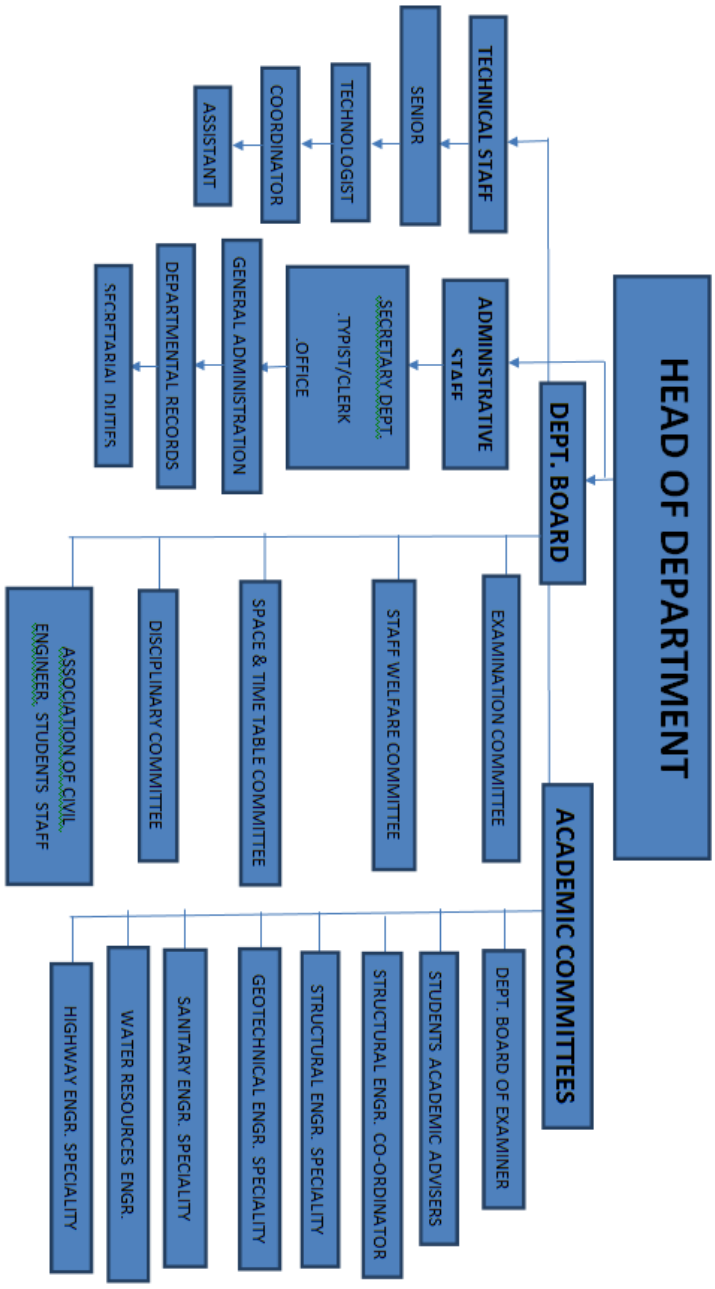
a. Policy adopted and practiced by the Department in pursuit of academic standards and maintenance of academic atmosphere is as follows:

To encourage pursuit of academic excellence, the Department;

(i) Insists on an oral project defense for final year students.

(ii) Encourages periodic seminars in respect of Civil engineering projects and design work usually carried out by the final year students.

The academic atmosphere is conducive since we have enough lecture rooms and equipped laboratories.


HEAD OF DEPARTMENT
DEPT. BOARD
ACADEMIC COMMITTEES
TECHNICAL STAFF
SENIOR
TECHNOLOGIST
COORDINATOR
ASSISTANT
ADMINISTRATIVE STAFF
SECRETARY DEPT.
.TYPIST/CLERK
.OFFICE
GENERAL ADMINISTRATION
DEPARTMENTAL RECORDS
SECRETARIAL DUTIES
EXAMINATION COMMITTEE
STAFF WELFARE COMMITTEE
SPACE & TIME TABLE COMMITTEE
DISCIPLINARY COMMITTEE
ASSOCIATION OF CIVIL ENGINEER. STUDENTS STAFF
DEPT. BOARD OF EXAMINER
STUDENTS ACADEMIC ADVISERS
STRUCTURAL ENGR. CO-ORDINATOR
STRUCTURAL ENGR. SPECIALITY
GEOTECHNICAL ENGR. SPECIALITY
SANITARY ENGR. SPECIALITY
WATER RESOURCES ENGR.
HIGHWAY ENGR. SPECIALITY