Masters of Science (MSc) Degree Programme Proposal

1. Introduction

The Center for Geotechnical and Coastal Engineering Research, domiciled under the Department of Civil and Environmental Engineering, University of Port Harcourt proposes to run the following Programmes at Post Graduate Levels as part of its mandate on Human Capital Development through Research in the Geotechnical & Coastal Environment.

- Master of Science (MSc) in Geotechnical and Coastal Engineering
- Master of Science (MSc) in Coastal Technology Management

2. Philosophy

The Philosophy of the MSc Programme is anchored on the drive of initiating, encouraging, promoting and sustaining advanced applied research and development in the various aspects of Geotechnical Engineering, Coastal Engineering and Coastal Technology Management.

3 Vision

To turn in internationally recognized Graduates whose Professionalism would be of immense benefit in tackling the problems associated with the Geotechnical and Coastal Environments. In addition, the MSc Programme also has the vision of preparing interested Graduates for further studies.

4 Mission

To create, preserve and apply knowledge obtained through Applied Research to the service of humanity through comprehensive Research and Development in the Geotechnical and Coastal Engineering fronts.

5. Justification / Rationale

Flood, Erosion and Ocean encroachment around Coast lines have made infrastructural development in such environment highly challenging, hence man is forced to thinker ways of living with the Sea environment. Exploring challenging Soils, Marine and Coastal environment therefore becomes inevitable, both for Geotechnical research and Infrastructural development.

Besides, the harsh Onshore Oil and Gas exploration, exploitation and processing activities deriving from Security threats and militancy in the host Onshore communities has forced International Oil and Gas companies (IOCs) to extend the frontiers of their activities Offshore, into the deep waters region. This further necessitates advanced research activities into the Coastal environment.

6. Aim & Objectives

Aim

The aim of the MSc programme in Geotechnical and Coastal Engineering and MSc programme in Coastal Technology Management is to prepare students for professional work in the respective Research areas or for further studies leading to the Doctor of Philosophy (PhD) in the relevant areas.

Objectives

To achieve the aim of the PostGraduate Diploma Programme in Geotechnical & Coastal Engineering, the following under listed objectives will be pursued:

1. Sourcing of highly qualified resource persons from both the academic and industrial worlds to deliver knowledge filled and experienced based lectures.
2. Organization of conferences, seminars and workshops in the relevant areas of interest.
3. Providing Internship opportunities for interested students in recognized industries.

7. Course Delivery

All lectures for every Programme shall be administered / delivered on modular basis from 08.00am to 04.00pm (with One Hour (12.00-01.00) break) from Mondays to Fridays. That is, 40 hours lecture per week per Course which is approximately equal to 14 weeks Semester of Academic work for a 3 Credit Units (2-Hours lecture plus1 Hour Practical or Tutorial per week) Course. Examination for a Course is taken after the Lectures on Saturdays, while the Continuous Assessment is done within the lecture periods as Practical reports, Test, Group Discussions, Field Trips reports and Assignments.

8. Examination Regulations & Scoring / Grading System

To qualify for sitting for a final Examination in a Course student is expected to have 75% lectures attendance of ALL lectures in that Course. The overall Examination score in a Course shall be 100% which shall comprise of:

Examination	-	70%
Continuous Assessment	-	30%

Every student is expected to score a minimum of 50% in the overall evaluation for a Course in order to PASS, otherwise he or she shall be deemed to have failed the Course. In which case, the student is allowed a second final chance to retake a Supplementary Examination in the Course which cannot be scored above a C-Grade. The Examination Grading shall be:

Score(%)	Grade	Grade Points
70 – 100	A	5.00
60 – 69	B	4.00
50 – 59	C	3.00
0 – 49	F	0.00

9. Programme Structure

1. **The full-time option** is is for a minimum of 12 calendar months and a maximum of 24 calender months .
2. **The part-time option** is for a minimum of 24 calender months and maximum of 48 calender months.

10. Career Opportunities

The main aim of the programmes of the Center is to produce a hands-on, Industry-ready Geotechnical Engineers and Coastal Engineers with a wide-range of Job Opportunities in Marine & Coastal Environment, Shore Protection, Artificial Intelligence, Dams, Port & Harbour, Geotechnical Services, Ocean Survey, Construction, Consultancy, Coastal Infrastructure Research & Development.

11. Programme Requirements & Criteria for the Award of the MSc Degree

To achieve the above objectives and qualify for the award of the MSc degree, the student must complete and pass all the prescribed courses in the chosen area of interest, participate in and present seminars and produced a well supervised dissertation on an approved research topic relevant to the interest of the Center.

12. Entry / Admission Requirements

To be admitted into any of the research areas in the MSc Degree programmes of the Center, a candidate must be in one of the following categories;

a) Candidate with a first degree in Civil Engineering and Coastal Engineering from any recognized University having a minimum of Second Class lower division (minimum CGPA of 3.00 on a 5-point scale or its equivalent) for admission into MSc Geotechnical and Coastal Engineering Programme;

b) Candidate with a first degree in Engineering and other relevant Science Disciplines from any recognized University having a minimum of Second Class lower division (minimum CGPA of 3.00 on a 5-point scale or its equivalent) for admission into MSc Coastal Technology Management Programme;

c) Candidate with a Post Graduate Diploma (PGD) in Engineering and other relevant Science Disciplines obtained from any recognized University having a minimum of an Upper Credit Pass (CGPA of 3.50 on a 5.00 point scale or its equivalent) for MSc Coastal Technology Management Programme.

d) Candidate with a Post Graduate Diploma (PGD) in Civil, Geotechnical and Coastal Engineering with a minimum of an Upper Credit Pass (CGPA of 3.50 on a 5.00 point scale or its equivalent) obtained from any recognized University) for MSc Geotechnical and Coastal Engineering Programme.

13. Course Listings

The course listings consist of: Compulsory courses and Electives. Details of the Courses are presented subsequently for the two research areas of the Center.

13.1 Course Listings for MSc in Geotechnical and Coastal Engineering Programme

a. Geotechnical Engineering Option

S/No	Course Code	Course Title	Credit Unit
1	GCE 801	Finite Element Modeling & Computer Applications	3
2	GCE 802	Earth Structures & Slopes	3
3	GCE 803	Embankments, Dam Engineering & Seepage	3
4	GCE 804	Engineering Behaviour & Properties of Soils	3
5	GCE 805	Rock & Tropical Soil Engineering	3
6	GCE 806	Soil Dynamics & Earthquakes Engineering	3
7	GCE 807	Probabilistic & Reliability Methods in Geotechnical Engineering	3
8	GCE 808	Theoretical Soil Mechanics	3
9	GCE 809	Geotechnical Investigation & Monitoring	3
10	GCE 823	Coastal Infrastructure	3
11	GCE 825	Applied Modeling of Nearshore Processes & Transport	3
12	SGS 801	ICT & Research Methodology	2
13	SGS 802	Management & Entrepreneurship	2
14	GCE 8XX	Elective	3
15	GCE 810	Internship Seminar	3
16	GCE 800	Dissertation	6
TECHNICAL ELECTIVES (CHOOSE ONE)			
17	GCE 811	Tunnel (Underground) Engineering	3
18	GCE 812	Special Topics in Geotechnical Engineering	3
19	GCE 813	Groundwater Hydrology & Exploration	3
20	GCE 831	Numerical Solutions of Differential Equations	3
21	GCE 832	Hydrodynamics for Coastal Engineers	3
22	GCE 833	Matlab for Oceanographers	3
		TOTAL	**49**

b. Coastal Engineering Option

S/No	Course Code	Course Title	Credit

			Unit
1	GCE 801	Finite Element Modeling & Computer Applications	3
2	GCE 803	Embankments, Dam Engineering & Seepage	3
3	GCE 821	Introduction to Coastal Engineering	3
4	GCE 822	Hydraulic Engineering Design	3
5	GCE 823	Coastal Infrastructure	3
6	GCE 824	Wave Mechanics	3
7	GCE 825	Applied Modeling of Nearshore Processes & Transport	3
8	GCE 826	Dynamics of Coastal Structures	3
9	GCE 827	Random Waves & Wave Forces	3
10	GCE 828	Coastal Engineering Measurements & Data Analyses	3
11	GCE 829	Coastal Hazards	3
12	SGS 801	ICT & Research Methodology	2
13	SGS 802	Management & Entrepreneurship	2
14	GCE 8XX	Elective	3
15	GCE 810	Internship Seminar	3
16	GCE 800	Dissertation	6
TECHNICAL ELECTIVES (CHOOSE ONE)			
17	GCE 811	Tunnel (Underground) Engineering	3
18	GCE 812	Special Topics in Geotechnical Engineering	3
19	GCE 813	Groundwater Hydrology & Exploration	3
20	GCE 831	Numerical Solutions of Differential Equations	3
21	GCE 832	Hydrodynamics for Coastal Engineers	3
22	GCE 833	Matlab for Oceanographers	3
		TOTAL	**49**

13.2. Geotechnical and Coastal Engineering Course Details

GCE 801 – Finite Element Modeling & Computer Applications (3 Credits)

Finite Element Methods; discretization of domains; Elements numbering techniques; Element Assembly and Solution of banded matrices, tridiagonal, pentadiagonal, etc 1-D, 2-D, and 3-D elements, Galerkin's weighted Residual Method (GWRM), collocation method, etc. Local and Global coordinates. Modeling, calibration, verification/validation and prediction. Computer/software applications to field and idealized problems, input data, output data interpretation with respect to Geotechnical and Coastal Engineering problems for instance, flood prediction, solute transport wave prediction, stress and strains in structures.

GCE 802 - Earth Structures & Slopes (3 Credits)

Equilibrium of Retained soil:- Limiting equilibrium analysis; Earth pressure theories; Lateral earth; Rigid retaining walls; sheet pile walls; anchored bulkhead. Deep excavations in soil; pressure distribution, base instability, bracing and other support methods; Earth anchored excavation; concrete diaphragm walls; Reinforced earth walls; cellular cofferdams; soft ground tunneling; Ground movement accompanying excavations and tunneling operations; Slope stability:- Design and analysis of slopes and embankments, circular and non-circular failure surfaces, concept of safety; Probabilistic slope stability analysis; stress strain and time-dependent behavior; Identification and control of slope stability problems; Graduate soil Laboratory.

GCE 803 – Embankments, Dam Engineering & Seepage (3 Credits)

Types of Dams, Design consideration; design details; site explorations; behavior of rockfills; stress-strain modeling, Finite element modeling, stresses, load transfer; Cracking; pore pressure; observations / monitoring; inspection and maintenance; foundation and abutment treatment, cut-off; causes of failure; Trailings dam, Permeability, flow equations; flow nets. Numerical analyses, Seepage analogies; unknown boundaries; Transfer conditions; Anisotropic seepage; layered systems; piping filters.

GCE 804 - Engineering Behaviour & Properties of Soils (3 Credits)

Continuum mechanics: principles, parameters and representation of soil properties; spaces, Framework of Critical state soil Mechanics; Behaviour of simple soils; Critical state models; Quantitative models of pore pressure; Strength behavior of Dilative Soils; Residual strength; failure theories, strength behavior of simple contractive soils; stress-strain relationships of soils; Constitutive models; Effective stress design methods, SHANSEP Soil physics, Chemistry and Mineralogy; Conduction Phenomena: coupled and uncoupled consolidation, compression, creep, time effects, sensitive soils; sampling and disturbances; Transient and Dynamic loading response; Effective of cycle loading; Graduate soil laboratory.

GCE 805 - Rock & Tropical Soil Engineering (3 Credits)

Introduction: Rock as an Engineering material; Geological classification; Engineering classification of intact Rocks; structural features in Rock masses; Engineering classification of in-situ Rock masses; in-situ state of stress; stress – strain - strength behavior. Analyses of stress and strain, Elastic relationships (isotropic, anisotropic); Deformability of discontinuities; failure criteria (intact, anisotropic, jointed); Property evaluation and Measurement: - Laboratory, field; Tropical soils: Chemical, physical, textural and engineering properties; Remote sensing and air photo

applications to Tropical soils engineering properties; geophysical techniques in tropical site characterization; Prediction of Engineering performance of tropical soils. Case histories.

GCE 806 - Soil Dynamics & Earthquakes Engineering (3 Credits)
Introduction: Dynamic response characteristics, wave propagation; Dynamic soil properties; Foundation response to vibrations, Blasting vibrations, Seismic slope stability analyses, Seismic design of retaining walls; Liquefaction; Seismic response of clays; Risks analyses and stability; Offshore dynamics. Engineering earthquakes from engineering point of view; Earthquake mechanism; Basic characteristics of strong ground motion; Response of simple systems to earthquakes; structural design for earthquakes, Seismic codes; Earthquake resistant designs; site effects; soil amplifications; Seismic risks & design decisions; Soil-structure interactions; nuclear reactor containment structures; Earth- - Dam Design (Seismic); fluids in tanks & reservoirs, blast loading.

GCE 807 - Probabilistic & Reliability Methods in Geotechnical Engineering (3 Credits)
Basic probability theory & applications; Common probability distributions and Geotechnical applications, Joint distributions; Moment approximations; Reliability of soil structures; system reliability and applications; Geotechnical applications of entropy and test biased distribution, the hazard function; Applications of diffusion theory to subsidence, consolidation and stress distribution (Probability consolidation, Probabilistic stress distribution); Markov Process and progressive slope failure; Time series analyses and groundwater fluctuation; Uncertainty and soil parameters; Decision making under uncertainty, site characterization.

GCE 808 - Theoretical Soil Mechanics (3 Credits)
Stress distribution in soils; Concept of stress and strain; Elastic equations; Applications to various loading and boundary conditions in soils; Stability problems in Soils: Failure theories; Development of conventional stability methods; Effects of retaining wall movements; Sokolovski's method of characteristics. Consolidation: Theoretical development and solution of one-dimensional consolidation; Higher-dimensional consolidation. Seepage: Theory of groundwater movement, method of fragments.

GCE 809 - Geotechnical Investigation and Monitoring (3 Credits)
Site Planning and design density of boreholes, sampling technology and disturbance, in-situ and laboratory testing, geophysical methods. Various aspects of ground instrumentation – monitoring of ground movements, drawdown, excess pore pressures, strut forces, wall deflection and observational methods.

GCE 821 - Introduction to Coastal Engineering (3 Credits)
Characteristics & Physical behavior of the Coastal Environment; Two dimensional wave equations & wave characteristics; Wave refraction, diffraction & reflection; Coastal sediment transport including nearshore currents, longshore onshore-offshore transport, and shoreline configuration; equilibrium beach profile concept with application to shore protection; shoreline modeling; tidal inlet hydrodynamics and inlet stabilization; design criteria for soft structures; Coastal zone processes & field Investigations – Wind wave measurements, Wave investigation facilities.

GCE 822 - Hydraulic Engineering Design (3 Credits)
The course covers the basics in hydraulics of open channel flow, hydraulic design of energy dissipation structures, spillways and outlets, turbines and surge tanks, hydraulic steel works and pipe hydraulics.

Theory, planning, analysis & design of hydraulic structures. Application of basic principles of detailed analysis & design. Engineering planning & design of water resource systems.

GCE 823 - Coastal Infrastructure (3 Credits)
Planning and design criteria of coastal infrastructure, including breakwaters, jetties, sea walls, groins, piers, submerged pipelines, harbor design, and tsunami defense. Use of laboratory models, numerical simulations, and field observations for design.

GCE 824 – Wave Mechanics (3 Credits)
Linear wave, boundary value problem formulation & solution; water particle kinematics, shoaling, refraction, diffraction, and reflection. Linear long wave theory with applications to tides, seiching, and storm surge. Long wave theory, wave superposition, wave height distribution, and the wind-wave spectrum, introduction to wave forces, and basic nonlinear properties of water waves. Theory of long waves. Depth-integrated Euler's equation & its jump conditions. Evolution equations & their solutions. Nonlinear shallow-water waves, the Korteweg-deVries equation and Boussinesq equation. Boundary-layer effects. Shallow-water waves on beaches. Applications of the fundamentals to problems of Tsunamis.

GCE 825 - Applied Modeling of Nearshore Processes & Transport (3 Credits)
Numerical modeling of the nearshore ocean, Numerical models for wave propagation, nearshore circulation, platform shoreline evolution and bathymetric profile evolution. Application to coastal phenomena, and the interpretation of model results;

Coastal features – Nearshore morphology, Crenulate bays, Sand waves, Beach cusps, Offshore sandbars; Equilibrium beach profiles; Sediment Characteristics & Transport; Long-Term Processes, Analyses, Modeling and Predictions of beaches & Shorelines; Shoreline Modification & Analyses.

GCE 826 - Dynamics of Coastal Structures (3 Credits)
Different types of Coastal structures and Compliant towers; New generation Offshore & Coastal structures; Environmental forces & Currents; Characteristics of single degree-of-freedom (DOF) models; Free, Forced, Underdamped & Damped single DOF systems; Two DOF systems; Eigenvalues & Eigenvectors & Orthogonality of modes; Multi-DOF systems – Natural frequencies & Mode shapes; Stodia, Raleigh-Ritz & Influence Coefficient methods; Continuous systems; Fluid – Offshore structures interactions (Jackets, Platforms, etc); Dynamic analyses of Articulated towers; Iterative frequency domains; Experimental & Analytical studies of Multi-legged articulated towers (MLAT); Tension legged Platforms (TLP) – Geometrical optimization and Dynamic analyses; TLPs under seismic excitation & Direct integration method; Stochastic Dynamics of Coastal structures – Response spectrum & Narrow band process; Return periods & Fatigue prediction; Modal response method, Modal mass contribution & Missing mass correction; Duhamel's integrals.

GCE 827 - Random Waves & Wave Forces (3 Credits)
Random Waves: Description of random waves (stochastic concept); spectral analysis of random waves; wave amplitude & height; Directional characteristics of Random seas; Special wave events; Waves in finite water depth (Non-Gaussian waves);

Introduction to types of structures and wave loads; methods to predict pulsating wave loads; predicting the Occurrence, Magnitude & Duration of impulsive wave loads; Stability analyses under impulsive loads; scaling physical model measurements of impulsive loads; wave loads on crown walls; changes to wave load advice in BS6349; Case studies & tutorial examples.

Wave forces on small & large members; dimensional analyses & scaling of equations, Identification & selection of force coefficients for Morison equation; compatibility of wave kinematics & force coefficients in Morison equation, diffraction and radiation of surface gravity waves by large floating bodies, wavemaker theory & problems, and reciprocity relations.

GCE 828 - Coastal Engineering Measurements & Data Analyses (3 Credits)

Coastal Engineering Measurements: Hands-on experience in the conduct of field & laboratory observations, including waves, currents, wind, tides, tsunami, sediments, bathymetry, shore profiles, wave forces on structures, and structural response. Online data archival & retrieval systems.

Data Analyses: Fourier transform applications to the processing of Coastal engineering related types of signals. Introduction to probability and statistics. Digital processing techniques. Laboratory work involving analysis of Coastal engineering-related signals using modern data acquisition systems

GCE 829 - Coastal Hazards (3 Credits)

Cascade of Natural, Biological & Human induced hazards; Perspectives on Coastal & Marine Hazards & Disasters; Tsunami Dynamics, forecasting & mitigations; Paleostorm surges & inundations; Storm surge warning, mitigation & adaptation; Sea level rise – Causes, impacts & scenarios for change; Storm induced morphology changes; Extreme waves, Rip currents; Sea Ice – hazards, risks & implications; Remote sensing of Coastal hazards; Mangroves, tropical cyclones & risk reduction; Coral reefs, Threats to marsh resources & mitigation; Living with harmful algae blooms.

SGS 801 – ICT & Research Methodology (2 Credits)

Essentials of Spreadsheets, Internet Technology, Statistical Packages, Precision & Accuracy of Estimates, Principles of Scientific Research, Concepts of Hypothesis, Formulation & Testing, Organisation of Research & report Writing.

SGS 802 – Management & Entrepreneurship (2 Credits)

Business Environment, General Management, Financial Management, Entrepreneurship Development, Feasibility Studies, Marketing & Managerial Problem Solving,

GCE 811 - Tunnel (Underground) Engineering (3 Credits)

Tunnel characteristics, clearances and ; Tunnel survey and preliminary investigation; soft ground tunneling; shield tunneling; Rock tunnels; mixed face tunneling, Tunnel-boring machines; Material handling and construction plant; shortcrete; cut and cover construction; safety provisions; drainage systems; tunnel operation and maintenance.

GCE 812 - Special Topics in Geotechnical Engineering (3 Credits)

Review of site appraisal & Engineering behavior of soils, foundation for structures – shallow foundations, deep foundations: piles, piers (caissons), bridge supports, Foundations in difficult ground conditions; Deep basements; Geotechnical Structures, Offshore Geotechnical Engineering; Offshore structures, Soil and Ground improvements;

land reclamation; Earthworks & Soil stabilization, Geotextiles and Geosynthetics; Environmental Geotechnical Engineering – ground movements (subsidence); Effects of pollution on the properties & engineering behavior of soils, Advanced Soil Mechanics, laboratory principles & procedures.

GCE 813 - Groundwater Hydrology & Exploration (3 Credits)

Groundwater as a renewable resource; occurrence, disposal and historic background; types of aquifers; measurement of soil misture; unsteady flows and measurement of hydraulic conductivity, transivity, and specific yield / storage coefficients; well hydraulics with considerations to Theis Jacob, Chow and Hantush methods; leaky aquifer, recovery methods, and Bolton's flow around fully and partially penetrating wells and well losses; well construction and drilling methods. Groundwater quality analyses, artificial recharge; surface and subsurface investigations and sea water intrusions.

GCE 831 - Numerical Solutions of Differential Equations (3 Credits)

Introduction, gaussian elimination, LU factorization & Cholesky factorization; Mathematical preliminaries on linear space, QR factorization by Gram-Schmidt & Householder transformation; Least squares fitting, condition number and stability; Iterative methods for linear systems, conjugate gradient method; Eigenvalue & eigenvector problem; Initial value problem of Ordinary Differential Equations. Euler's method, Explicit Runge-Kutta methods, convergence rate analysis, stiff equations & absolute stability; Quadrature integration & Implicit Runge-Kutta and multistep methods; Two point boundary value problems, finite difference & shooting methods. Partial Differential Equation - 1: Poisson equations; Partial Differential Equation - 2: Diffusion equations, consistency, order & stability. Lax Equivalence Theorem; Partial Differential Equation - 3: Stability analysis: eigenvalue approach & Fourier transform approach, advection equations.

GCE 832 - Hydrodynamics for Coastal Engineers (3 Credits)

Periodic wave pattern: the approach of differential calculus, the control volume approach. Wave effects on coasts. Wind generated waves: basic concepts. Analysis of the sea states: the time domain. The wave climate. Design waves and risk analysis. Analysis of the sea states in the space-time. The theory of Quasi- Determinism theory. Analysis of the wave forces on offshore structures. Stability analysis of coastal structures.

Introduction to wave mechanics, a review of hydrodynamics and vector analysis, small amplitude water wave theory, formulation and solution, engineering wave properties, long waves, wave statistics and spectra, wave forces, waves over real sea beds, nonlinear properties derivable from small amplitude waves, nonlinear waves, a series of experiments for a laboratory course component in water waves.

GCE 833 - Matlab for Oceanographers (3 Credits)

Introduction to MATLAB desktop environment, Basic programming and data analysis skills, Matrix algebra & Vectorization of functions, Writing optimized routines to analyze data sets, Basic graphics & visualization, Two-dimensional & three-dimensional Graphing, Contouring & Movies; Scalar & Vector Space - Time Series at fixed locations & Moving locations (Shipboard surveys), Oceanographic characteristics varying in both three-dimensions & Time; Matlab-based Processing, Analyses & Visualization of large Oceanographic data-Sets;

13.3 Courses Listing for MSc in Coastal Technology Management

S/No	Course Code	Course Title	Credit Unit
1	GCE 801	Finite Element Modeling & Computer Applications	3
2	GCE 802	Earth Structures & Slopes	3
3	GCE 821	Introduction to Coastal Engineering	3
4	GCE 823	Coastal Infrastructure	3
5	GCE 824	Wave Mechanics	3
6	GCE 826	Dynamics of Coastal Structures	3
7	GCE 828	Coastal Engineering Measurements & Data Analyses	3
8	GCE 829	Coastal Hazards	3
9	GCE 840	Project Management	3
10	GCE 841	Risk Management	3
11	GCE 842	Operations and Maintenance Management	3
12	SGS 801	ICT & Research Methodology	2
13	SGS 802	Management & Entrepreneurship	2
14	GCE 83X	Technical Elective	3
15	GCE 810	Internship Seminar	3
16	GCE 800	Dissertation	6
		TOTAL	**49**
TECHNICAL ELECTIVES (CHOOSE ONE)			
17	GCE 831	Numerical Solutions of Differential Equations	3
18	GCE 832	Hydrodynamics for Coastal Engineers	3
19	GCE 833	Matlab for Oceanographers	3

13.3. MSc Coastal Technology Management Course Details

GCE 801 – Finite Element Modeling & Computer Applications (3 Credits)

Finite Element Methods; discretization of domains; Elements numbering techniques; Element Assembly and Solution of banded matrices, tridiagonal, pentadiagonal, etc 1-D, 2-D, and 3-D elements, Galerkin's weighted Residual Method (GWRM), collocation method, etc. Local and Global coordinates. Modeling, calibration, verification/validation and prediction. Computer/software applications to field and idealized problems, input data, output data interpretation with respect to Geotechnical and Coastal Engineering problems for instance, flood prediction, solute transport wave prediction, stress and strains in structures.

GCE 802 - Earth Structures & Slopes (3 Credits)

Equilibrium of Retained soil:- Limiting equilibrium analysis; Earth pressure theories; Lateral earth; Rigid retaining walls; sheet pile walls; anchored bulkhead. Deep excavations in soil; pressure distribution, base instability, bracing and other support methods; Earth anchored excavation; concrete diaphragm walls; Reinforced earth walls; cellular cofferdams; soft ground tunneling; Ground movement accompanying excavations and tunneling operations; Slope stability:- Design and analysis of slopes and embankments, circular and non-circular failure surfaces, concept of safety; Probabilistic slope stability analysis; stress strain and time-dependent behavior; Identification and control of slope stability problems; Graduate soil Laboratory.

GCE 821 - Introduction to Coastal Engineering (3 Credits)
Characteristics & Physical behavior of the Coastal Environment; Two dimensional wave equations & wave characteristics; Wave refraction, diffraction & reflection; Coastal sediment transport including nearshore currents, longshore onshore-offshore transport, and shoreline configuration; equilibrium beach profile concept with application to shore protection; shoreline modeling; tidal inlet hydrodynamics and inlet stabilization; design criteria for soft structures; Coastal zone processes & field Investigations – Wind wave measurements, Wave investigation facilities.

GCE 822 - Hydraulic Engineering Design (3 Credits)
The course covers the basics in hydraulics of open channel flow, hydraulic design of energy dissipation structures, spillways and outlets, turbines and surge tanks, hydraulic steel works and pipe hydraulics.
Theory, planning, analysis & design of hydraulic structures. Application of basic principles of detailed analysis & design. Engineering planning & design of water resource systems.

GCE 823 - Coastal Infrastructure (3 Credits)
Planning and design criteria of coastal infrastructure, including breakwaters, jetties, sea walls, groins, piers, submerged pipelines, harbor design, and tsunami defense. Use of laboratory models, numerical simulations, and field observations for design.

GCE 824 – Wave Mechanics (3 Credits)
Linear wave, boundary value problem formulation & solution; water particle kinematics, shoaling, refraction, diffraction, and reflection. Linear long wave theory with applications to tides, seiching, and storm surge. Long wave theory, wave superposition, wave height distribution, and the wind-wave spectrum, introduction to wave forces, and basic nonlinear properties of water waves. Theory of long waves. Depth-integrated Euler's equation & its jump conditions. Evolution equations & their solutions. Nonlinear shallow-water waves, the Korteweg-deVries equation and Boussinesq equation. Boundary-layer effects. Shallow-water waves on beaches. Applications of the fundamentals to problems of Tsunamis.

GCE 825 - Applied Modeling of Nearshore Processes & Transport (3 Credits)
Numerical modeling of the nearshore ocean, Numerical models for wave propagation, nearshore circulation, platform shoreline evolution and bathymetric profile evolution. Application to coastal phenomena, and the interpretation of model results;

Coastal features – Nearshore morphology, Crenulate bays, Sand waves, Beach cusps, Offshore sandbars; Equilibrium beach profiles; Sediment Characteristics & Transport; Long-Term Processes, Analyses, Modeling and Predictions of beaches & Shorelines; Shoreline Modification & Analyses.

GCE 826 - Dynamics of Coastal Structures (3 Credits)

Different types of Coastal structures and Compliant towers; New generation Offshore & Coastal structures; Environmental forces & Currents; Characteristics of single degree-of-freedom (DOF) models; Free, Forced, Underdamped & Damped single DOF systems; Two DOF systems; Eigenvalues & Eigenvectors & Orthogonality of modes; Multi-DOF systems – Natural frequencies & Mode shapes; Stodia, Raleigh-Ritz & Influence Coefficient methods; Continuous systems; Fluid – Offshore structures interactions (Jackets, Platforms, etc); Dynamic analyses of Articulated towers; Iterative frequency domains; Experimental & Analytical studies of Multi-legged articulated towers (MLAT); Tension legged Platforms (TLP) – Geometrical optimization and Dynamic analyses; TLPs under seismic excitation & Direct integration method; Stochastic Dynamics of Coastal structures – Response spectrum & Narrow band process; Return periods & Fatigue prediction; Modal response method, Modal mass contribution & Missing mass correction; Duhamel's integrals.

GCE 827 - Random Waves & Wave Forces (3 Credits)

Random Waves: Description of random waves (stochastic concept); spectral analysis of random waves; wave amplitude & height; Directional characteristics of Random seas; Special wave events; Waves in finite water depth (Non-Gaussian waves);

Introduction to types of structures and wave loads; methods to predict pulsating wave loads; predicting the Occurrence, Magnitude & Duration of impulsive wave loads; Stability analyses under impulsive loads; scaling physical model measurements of impulsive loads; wave loads on crown walls; changes to wave load advice in BS6349; Case studies & tutorial examples.

Wave forces on small & large members; dimensional analyses & scaling of equations, Identification & selection of force coefficients for Morison equation; compatibility of wave kinematics & force coefficients in Morison equation, diffraction and radiation of surface gravity waves by large floating bodies, wavemaker theory & problems, and reciprocity relations.

GCE 828 - Coastal Engineering Measurements & Data Analyses (3 Credits)

Coastal Engineering Measurements: Hands-on experience in the conduct of field & laboratory observations, including waves, currents, wind, tides, tsunami, sediments, bathymetry, shore profiles, wave forces on structures, and structural response. Online data archival & retrieval systems.

Data Analyses: Fourier transform applications to the processing of Coastal engineering related types of signals. Introduction to probability and statistics. Digital processing techniques. Laboratory work involving analysis of Coastal engineering-related signals using modern data acquisition systems

GCE 829 - Coastal Hazards (3 Credits)

Cascade of Natural, Biological & Human induced hazards; Perspectives on Coastal & Marine Hazards & Disasters; Tsunami Dynamics, forecasting & mitigations; Paleostorm surges & inundations; Storm surge warning, mitigation & adaptation; Sea level rise – Causes, impacts & scenarios for change; Storm induced morphology changes; Extreme waves, Rip currents; Sea Ice – hazards, risks & implications; Remote sensing of Coastal hazards; Mangroves, tropical cyclones & risk reduction; Coral reefs, Threats to marsh resources & mitigation; Living with harmful algae blooms.

GCE 840 - Project Management (3 Credits)

Project Management Overview; Identify project management processes, professional and social responsibilities, interpersonal skills required for a project management. Project Management Methodology, Project Management Toolset, Project Management Documentation, System Development Life Cycle, Initiating a Project; Examine the Project management content, Examine project selection, Prepare a project statement of work, Create a project charter, Identify project stakeholders. The Planning Phase; Identify elements of the project management plan, Document stakeholder requirements, Create a scope statement, develop a work breakdown structure. Development Project Schedules; Create an activity list, Create a project charter, Identify the critical path, Optimize the project schedule, Establish a schedule baseline. The analysis phase, the design phase, the implementation phase, Evaluation phase, Changing information systems and Project management assessment.

GCE 841 - Risk Management (3 Credits)

Principles of Risk and Risk Management; introduction to the principles and concepts of risk and risk management, Identify the risk associated with the goals of an organization, history of risk management, development and impact of international standards. Practice of Risk Management; explores the impact of the global business environment on risk, examines issues relevant to specific sectors and geographical areas and the needs and demands of various stakeholder groups, including regulatory authorities. Risk Assessment; To quantify and prioritize the risk, nature of risk- losses and opportunities, sources and types of risk information that help identify, record and communicate risk effectively, examine the different techniques for identifying risks and explore common methods for analyzing risks and uncertainties. Risk Treatment; To develop appropriate responses to the prioritized risk. Role of risk treatment within the wider enterprise, risk management framework, different approaches to effectively respond to opportunities and treat threats, evolving risk management fundamental tools, monitoring the impact of risk on the organization. Risk, Governance and Culture; Examines issues of corporate governance, risk oversight, internal control and assurance in a global marketplace. Role of the board and key stakeholders in ensuring that risk is integrated with strategy. Critical elements of organizational behaviours including culture, corporate social responsibility and business ethics. Crises, Resilience and Future Risks; A demonstration exercise to develop a framework to help organisations strengthen their resilience at strategic, tactial and operational levels to face current and future risks. Using case studies from different business sectors and geographical regions to analyze how crises are managed.

GCE 842 - Operations and Maintenance Management (3 Credits)

Introduction to Operations and Maintenance; trends in maintenance management- definitions and terminology. Types of Maintenance, choice of maintenance strategy and methods, NORSOK Standards, legislative requirements and governmental regulations. Establishment of goals, requirements and risk acceptance criteria with respect to Health, safety and environment. Principal Concepts, Tools and Techniques;- Engineering analysis, equipment, technical and functional hierarchy, failure mode effects and Critical Analysis, Fault Tree Analysis, Event Tree Analysis. Design out/design for maintenance considering reliability, availability,maintainability, operations and maintenance support, life cycle cost Analysis, Spare parts inventory and logistics, data and information management, defining best practices, excellence and culture. Defining terms related to maintenance, reliability and

Operations (MRO), Elements of asset (equipment) performance, identifying stakeholders to journey to excellence. Maintenance Strategies and Practices;- Preventive maintenance (PM), Predictive/condition based maintenance (PBM/CBM), Run-to-failure (RTF), Planning and scheduling, Material stores management, optimizing maintenance based on reliability centered maintenance. Maintenance Management and Development of Maintenance Progams;- Standards and Standardization impacting maintenance and equipment care, energy, environment, risk, asset etc. Reliability centered maintenance (RCM), Risk based Maintenance (RBM) and Risk based inspections (RBI), Maintenance objectives and strategies, maintenance management and work processes, challenges in implementing best practices.

SGS 801.1 – ICT & Research Methodology (2 Credits)

Essentials of Spreadsheets, Internet Technology, Statistical Packages, Precision & Accuracy of Estimates, Principles of Scientific Research, Concepts of Hypothesis, Formulation & Testing, Organisation of Research & report Writing.

SGS 802.2 – Management & Entrepreneurship (2 Credits)

Business Environment, General Management, Financial Management, Entrepreneurship Development, Feasibility Studies, Marketing & Managerial Problem Solving,

GCE 831 - Numerical Solutions of Differential Equations (3 Credits)

Introduction, gaussian elimination, LU factorization & Cholesky factorization; Mathematical preliminaries on linear space, QR factorization by Gram-Schmidt & Householder transformation; Least squares fitting, condition number and stability; Iterative methods for linear systems, conjugate gradient method; Eigenvalue & eigenvector problem; Initial value problem of Ordinary Differential Equations. Euler's method, Explicit Runge-Kutta methods, convergence rate analysis, stiff equations & absolute stability; Quadrature integration & Implicit Runge-Kutta and multistep methods; Two point boundary value problems, finite difference & shooting methods. Partial Differential Equation - 1: Poisson equations; Partial Differential Equation - 2: Diffusion equations, consistency, order & stability. Lax Equivalence Theorem; Partial Differential Equation - 3: Stability analysis: eigenvalue approach & Fourier transform approach, advection equations.

GCE 832 - Hydrodynamics for Coastal Engineers

Periodic wave pattern: the approach of differential calculus, the control volume approach. Wave effects on coasts. Wind generated waves: basic concepts. Analysis of the sea states: the time domain. The wave climate. Design waves and risk analysis. Analysis of the sea states in the space-time. The theory of Quasi- Determinism theory. Analysis of the wave forces on offshore structures. Stability analysis of coastal structures.

Introduction to wave mechanics, a review of hydrodynamics and vector analysis, small amplitude water wave theory, formulation and solution, engineering wave properties, long waves, wave statistics and spectra, wave forces, waves over real sea beds, nonlinear properties derivable from small amplitude waves, nonlinear waves, a series of experiments for a laboratory course component in water waves.

GCE 833 - Matlab for Oceanographers (3 Credits)

Introduction to MATLAB desktop environment, Basic programming and data analysis skills, Matrix algebra & Vectorization of functions, Writing optimized routines to analyze data sets, Basic graphics & visualization, Two-dimensional & three-dimensional Graphing, Contouring & Movies; Scalar & Vector Space - Time Series at fixed

locations & Moving locations (Shipboard surveys), Oceanographic characteristics varying in both three-dimensions & Time; Matlab-based Processing, Analyses & Visualization of large Oceanographic data-Sets;

14. Graduation Requirements

To be awarded the MSc degree in Geotechnical and Coastal Engineering or MSc degree in Coastal Engineering Technology, students' must have passed all prescribed courses with a total credit unit of 49 units.

15. List of Participating Lecturers / Instructors

S/Nos	Names	Qualifications	Specialization	Rank
1	Ejezie, S.U.	PhD, MSc., BSc., R.Engr (COREN).	Geotechnical Engineering	Professor
2	Nwaogazie, I.L.	PhD, MSc., BSc., R.Engr (COREN).	Engineering Modeling	Professor
3	Teme, S.C.	PhD, MSc., BSc., (FNMGS).	Geology & Geotechnical Engg	Professor (RSU)
4	Jimoh, Y.	PhD, MSc., BSc., R.Engr (COREN).	Geotechnical Engg	Professor (Unilorin)
5	Oguara, T.M.	PhD, MSc., BSc., R.Engr (COREN).	Highway Engineering	Professor
6	Johnary, T.	PhD, MSc., BSc., R.Engr (COREN).	Engineering Structures	Professor
7	Igwe, E.A.	PhD, MTech., BTech., R.Engr (COREN)	Highway Engineering	Reader (RSU)
8	Ossia, C.V.	PhD, MTech., BTech., R.Engr (COREN).	Applied Mechanics	Senior Lecturer
9	Big-Alabo, A.	PhD, MSc., B.Eng., R.Engr (COREN).	Applied Mechanics	Senior Lecturer
10	Douglas, I.E.	PhD, MTech., R.Engr (COREN)	Marine Engineering & Turbines	Senior Lecturer (RSU)
11	Orji, C.U.	PhD, MSc., BTech., R.Engr (COREN)	Marine Engineering	Senior Lecturer (RSU)
12	Tamunodukobipi, D.	PhD, MTech., BTech., R.Engr (COREN).	Applied Rotodynamics	Senior Lecturer (RSU)
13	Akandu, E.	PhD, MTech., BTech	Marine & Offshore Structures	Senior Lecturer (RSU)
14	Nwofor, T. C.	PhD, M.Tech., B.Tech. R.Engr (COREN).	Engineering Structures	Senior Lecturer
15	Eme, D.B.	PhD, M.Tech., B.Tech., R.Engr (COREN).	Highway Engineering	Senior Lecturer
16	Nwaobakata, E.	PhD, M.Tech., B.Tech., R.Engr (COREN).	Highway Engineering	Senior Lecturer
17	Sule, S.	PhD, M.Tech., B.Eng., R.Engr (COREN).	Engineering Structures	Senior Lecturer
18	Ugwoha, E.	PhD, MSc, BTech., R.Engr	Environmental	Senior Lecturer

		(COREN)	Engineering	
19	Kamalu, U.A.	PhD, MEng., BEng., R.Engr (COREN)	Electronics Engineering	Senior Lecturer
20	Ukpong, E.U.	PhD, MSc, BSc., R.Engr (COREN)	Geotechnical Engineering	Senior Lecturer (UNIUYO)
21	Nwaigwe, C.	PhD, MSc., BSc.	Computation Fluid Dynamics	Lecturer-1 (RSU)
22	Ibekwe, A.U.	PhD, M.Tech., B.Tech., R.Engr (COREN).	Marine Engineering Platforms	Industry (SNEPCO)
23	Tam-Jones, Atuboyedia	PhD, M.Tech., B.Tech., R.Engr (COREN)	Highway Engineering	Industry
24	Orusoso, P.	MTech., BTech., R.Engr (COREN)	Engineering Structures	Industry
25	Henshaw, T.	PhD., MEng., BEng., R.Eng (COREN)	Water Resources	Industry
26	Ikebude, C.	PhD., MEng., BEng., R.Eng (COREN)	Water Resources	Lecturer 1
27	Raheem, K.	MEng, BEng	Marine (Hydrological) Survey	Lecturer 1
28	Okoni, B.	PhD, MSc, BSc	Computer Science	Lecturer 1
29	Ohwerhi, K.E.	M.Eng., BEng.	Highway Engineering	Research Assistant

16 Facilities

16.1 Personnel

Being multi-disciplinary in nature, academic Faculty is drawn different academia from relevant Disciplines at the University of Port Harcourt, Other Sister Universities and Industry. The current list of proposed teaching faculty is shown above. However, more Teachers, Instructors and Researchers of high professional repute shall be co-opted as collaborators to build a center of Excellence in Geotechnical and Coastal Engineering. Besides, there are two Professorial Chairs domiciled in the Center, namely: Enoch George Professorial Chair in Geotechnical Engineering and the Gesi Assamaowei Professorial Chair in Coastal Engineering Research

16.2 Offices & Classrooms Space

Besides, the Director's Office, there are two other Offices at ETF Gas Engineering Building for the Center of Geotechnical Engineering and Coastal Engineering which can house the Administrative staff of the Center. The Center also has another four (4) Classrooms domiciled at the Civil & Environmental Engineering Building at UniPark (Abuja) Campus of the University of Port Harcourt.

16.3 Library / Laboratory Facilities

Currently, the Faculty of Engineering eLibrary, Donald Ekong (Uniport) Library and the World Bank Center of Excellence in Oilfield Chemicals (ACE-CEFOR) have full Access to Research Libraries. (Online and Offline). The Center currently collaborates with the Center of Excellence in Marine & Offshore Engineering, Rivers State University to share Laboratory Facilities built and equipped by Shell Petroleum Development Company (SPDC) to enhance research in this area.