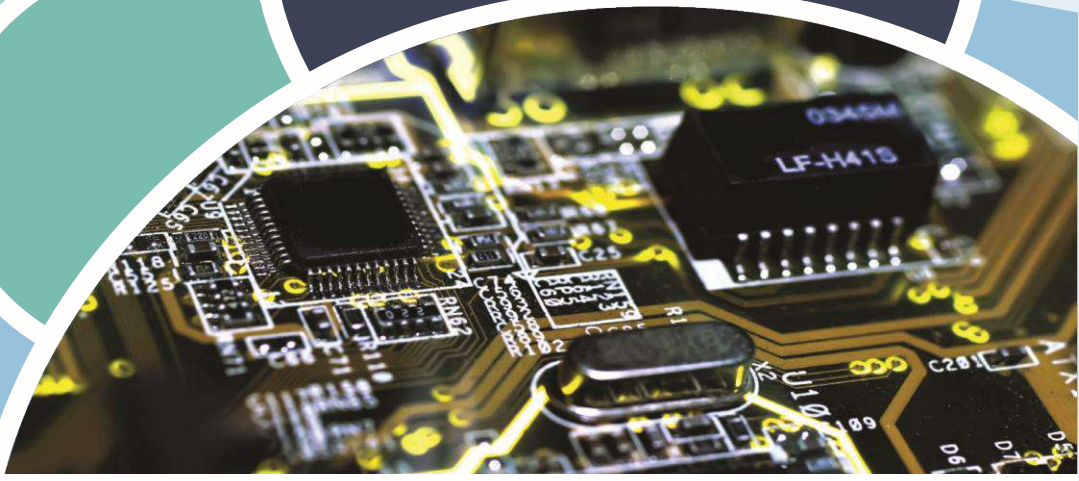
FACULTY OF

ENGINEERING



PART (1)

Civil Engineering [B.Sc]

VISION AND MISSION

The VISION of the Civil Engineering Department is to be recognized locally and regionally as a leading department providing high quality education, researches and services.
The MISSION is to provide students with the highest level of theoretical and practical education that leads them to successful careers. The department programmess prepare graduates to build effective and interactive skills to face new challenges as high caliber Civil Engineers to enable them to contribute effectively and professionally to society.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Engineering, has to:

1. Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry, computer or engineering sciences. International students who have not studied Arabic and religious studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.
3. Apply electronically though the website of the Admission and Accreditation Office, Ministry of Higher Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Engineering- .
4. Pay the published fees: 15,000 SDG or US $ 3,500 [international students]

CAREER ADVICE :

A Sudanese graduate of the Faculty of Engineering with BSC (CE) knows that it is the oldest and one of the most important branches of engineering profession all over the world and that is due to the fact that civil engineering is related to almost all aspects of civilization. Many of the important things in our lives that we take for granted are the product of civil engineering. Civil engineer deals with a wide variety of engineering aspects such as designing, construction, and maintenance of different structure (buildings, embankments, storage tanks, dams, roads, water and wastewater networks, irrigation and drainage networks, etc…..), solving execution problems, managing engineering and construction projects, and it just does not end there. Civil engineer also has a significant role in planning and managing transportation systems, terrific safety, conservation and development of water resources, treatment and reuse of wastewater, and the list extends. The civil engineering curriculum in National University – Sudan is set to serve the broad range activities of the profession. It is designed to fulfill the student's need of sufficient and balanced content of different civil engineering topics. The graduate can go in any one of the above areas, and be immediately enrolled in jobs. A graduate may choose to obtain masters or PhD in the subspecialties of civil engineering. International students are allowed to take engineering jobs in Sudan.

FACULTY OBJECTIVES

The objectives of the National University Faculty of Engineering –Civil Engineering Department are to:

1. Ensure that graduates will have a mastery of fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities necessary for entering civil engineering career and/or higher studies.

2. Produce graduates that have the knowledge and skills necessary for identifying and assessing design alternatives and the related social, economic, environmental, and public safety impacts.

3. Produce graduates who have verbal and written communication skills necessary for successful professional practice.

4. Prepare graduates to function effectively on teams.

5. Prepare graduates to deal with ethical and professional issues, taking into account the broader societal implications of civil engineering.

6. Prepare graduates for professional careers, leadership roles and life-long learning.

Curriculum Objectives [Characteristics of the civil engineering graduate

A graduate of the National University Civil Engineering Curriculum should be able to:

1. Show ability to apply knowledge of mathematics, science, and engineering.
2. Demonstrate the skills to design and conduct experiments, as well as to analyze and interpret data.
3. Show ability to design a system, component, or process to meet desired needs.
4. Present attitudes to function on multi-disciplinary teams.
5. Identify, formulate and solve engineering problems.
6. Show understanding of professional and ethical responsibility.
7. Communicate effectively.
8. Discuss the impact of engineering solutions in a global and societal context.
9. Recognize the need for, and an ability to engage in life-long learning
10. Show awareness of contemporary issues.
11. Use, skillfully the techniques, skills, and modern engineering tools necessary for engineering practice.
12. Plan, design, construct, maintain, and operate of large and permanent engineering projects of our civilization. Civil engineers are in demand wherever there are people.
13. Discuss the major subdivisions of civil engineering are structural, geotechnical, environmental, sanitary, water resources, and transportation engineering.
14. Outline the components of projects as bridges and large buildings, dams, and other river and harbor work, municipal water supply and sanitation facilities, streets, highways, and other transportation facilities.

TIMETABLE

The student has to earn 190 credit hours to obtain a B.Sc. degree in Civil engineering. The study programme for BSc students in the Civil Engineering Department is distributed over 10 semesters as follows:

Semester 1 [22 CHs - 17 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Physics I	PHY111	2	1	2	3
2	Chemistry	CHM 111	2		3	3
3	Engineering Mechanics I (Statics)	MAT 113	2	2		3
4	Calculus I	MAT111	2	2	-	3
5	Linear Algebra	MAT 112	2	2		3
6	English Language I	ENL111	3	-	-	3
7	Engineering Drawing I	GEN 121	1	3		2
8	Sudanese Culture	SCL111	2	-	-	2
			17	10	7	22

Semester 2 [21 CHs- 18 weeks]

	Title	Code	Units			CH

			Th	Tut	Lab	
1	Analytic Geometry	MAT 122	2	2		3
2	Engineering Mechanics II (Dynamics)	MAT 123	2	2		3
3	Introduction to Computer	COM111	1	-	2	2
4	English Language II	ENL121	2			3
5	Physics II	PHY 121	2	1	2	3
6	Calculus II	MAT 121	2	2		3
7	Engineering Drawing II	GEN 121	1	3		2
8	Fundamentals of Engineering	GEN122	2	-	-	2
			15	10	4	21

Semester 3 [19 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Differential Equations	MATH211	2	2	-	3
2	Introduction to Civil Engineering	CE212	2			2
3	Mechanics of Material I	CE213	2	2	2	4
4	Civil Engineering Drawing I	CE214	2	4	0	3
5	Engineering Geology	MISS215	3	-	-	3
6	Engineering Surveying	CE216	3	2		4
			14	11	2	19

Semester 4 [18 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Numerical Methods	MATH221	2	2	-	3
2	Mechanics of Material II	CE222	2	2	2	4
3	Civil Engineering Drawing II	CE223	2	4	0	3
4	Introduction to Geotechnical Engineering	CE224	2	-	-	2
5	Basic Electro-Mechanical Engineering	MISS225	4	2	-	5

6	Engineers in Society	MISS226	1			1
			13	10	2	18

Semester 5 [19 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Structural Analysis I	CE311	3	2	-	4
2	Engineering Properties of Soils and Measurements	CE312	2	2	-	3
3	Construction Engineering	CE313	2	-	-	2
4	Concrete Technology	CE314	2	-	-	2
5	Fluid Mechanics for Civil Engineers	CE315	3	-	2	4
6	Advanced Engineering Surveying	CE316	3	2		4
			15	6	2	19

Semester 6 [18 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Reinforced Concrete Design I	CE321	3	3	-	4
2	Construction Management	CE322	2	-	-	2
3	Hydraulics	CE323	3	-	2	4
4	Computer Programming	COMP324	1	2		2
5	Statistics for Engineers	MATH325	2	2		3
6	Remote Sensing	CE326	2	2		3
			13	9	2	18

Semester 7 [19 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Structural Analysis II	CE411	3	2	-	4
2	Soil Mechanics	CE412	2	2		3
3	Engineering Economics	CE413	2	-	-	2
4	Hydrology and Water Resources Engineering	CE414	2	-	-	2
5	Design of Steel Structures	CE415	3	3	-	5
6	Dynamics of Structures	CE416	2	2		3
			14	9	0	19

Semester 8 [17 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Reinforced Concrete Design II	CE421	3	3	-	5
2	Transportation Engineering	CE422	3	2		4
3	Environmental Engineering	CE423	2	2	-	3
4	Groundw ater Engineering	CE424	2	-	-	2
5	Foundation Engineering	CE425	2	2		3
			12	9	0	17

Semester 9 [18 CHs- 18 weeks]

	Title	Code	Units			CH

			Th	Tut	Lab	
1	Structural Analysis III	CE511	3	2		3
2	Highw ay Design & Construction	CE512	2	2	-	3
3	Design of Hydraulic Structures	CE513	2	2	-	3
4	Environmental Engineering Design	CE514	2	2		3
5	Quantity Surveying & Estimation	CE515	2	2		3
6	Graduation Project –I	CE516		6		3
			11	16	0	18

Semester 10 [17 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Improvement of Geotechnical Materials	CE 521	2	-	-	2
2	Computer-Aided Design Of Structures	CE 522		4		2
3	Bridge Design	CE 523	3	2		4
4	Elective from CE Dept	CE 524	3			3
5	Elective from CE Dept	CE 525	3			3
6	Graduation Project –II	CE526		6		3
			11	12	0	17

COURSE OUTLINES

Title	*Code*	*Semester/Duration*	*Credits*
PHYSICS-1	PHYS-114	1/Longitudinal	3,0,3

Physical optics: theories of light; Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference at wedge shaped films, Newton's rings, interferometers; diffraction of light; Fresnel and Fraunhoffer diffraction, diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and n-slits-diffraction grating; polarization; production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction, retardation plates, nicol

prism, optical activity, polarimeters, polaroid.

Waves and oscillations: differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Lissajous figures, spring-mass system, calculation of time period of torsional pendulum, damped oscillation, determination of damping co-efficient; forced oscillation, resonance, two-body oscillations, reduced mass, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.

Heat and thermodynamics: principle of temperature measurements: platinum resistance thermometer, thermoelectric thermometer, pyrometer; kinetic theory of gases: Maxwell's distribution of molecular speeds, mean free path, equipartition of energy, Brownian motion, Vander Waal's equation of state, review of the first law of thermodynamics and its application, reversible and irreversible processes, second law of thermodynamics, Carnot cycle; efficiency of heat engines, Carnots theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, third law of thermodynamics.

Title	*Code*	*Semester/Duration*	*Credits*
CHEMISTRY-I	CHEM-115	1/Longitudinal	3,0,3

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger's wave equation, electronic configurations and properties of atoms; electronic configurations and properties of molecules: chemical bond, valence bond theory molecular orbital theory, shape of molecules, bond length, bond energy; chemistry of halogen, alkali metals, alkaline earth metals, non-metals and heavy metals; modern concepts of acids and bases; different types of solutions; properties of dilute solution; thermochemistry; electrochemistry: voltaic cells, electrolytic cells; colloids and colloidal solution; chemical and ionic equilibria; chemistry of water; chemistry of water pollution; chemistry of cements, silicates and limes.

Title	*Code*	*Semester/Duration*	*Credits*
MATHEMATICS-I: DIFFERENTIAL AND INTEGRAL CALCULUS, MATRICES	MATH-117	1/Longitudinal	3,0,3

Differential calculus: limit, continuity and differentiability; successive differentiation and Leibnitz's theorem; expansion of functions; indeterminate forms; partial differentiation; Euler's theorem; tangent and normal; maxima and minima of functions of single variables.

Integral calculus: integration by parts; standard integrals; integration by the method of successive reduction; definite integrals; beta function; gamma function; multiple

integrals.

Matrices: definition of different kinds of matrices; algebra of matrices; inverse of matrix; rank and elementary transformation of matrices; solution of system of linear equations; Eigen values and Eigen vectors; CayleyHamilton theorem.

Title	*Code*	*Semester/Duration*	*Credits*
MATHEMATICS-II: VECTOR ANALYSIS	MATH-118	1/Longitudinal	3,0,3

Vector analysis: scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence and independence of vectors; definition of line, surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications.

Title	*Code*	*Semester/Duration*	*Credits*
PHYSICS-II	PHYS-114	2/Longitudinal	3,0,3

Structure of matter : crystalline and non-crystalline solids, single crystal and polycrystal solids, unit cell, crystal systems, coordinations number, crystal planes and directions, NaCl and CsClstructure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's law, methods of determination of interplanar spacing from diffraction patterns; defects in solids: point defects, line defects, bonds in solids, interatomic distances, calculation of cohesive and bonding energy; introduction to band theory: distinction between metal, semiconductor and insulator.

Electricity and magnetism: Coulomb's law, electric field (E), Gauss's law and its application, electric potential (V), capacitors and capacitance, capacitors with dielectric, dielectric and atomic view, charging and discharging of a capacitor, Ohm's law, Kirchoff's law; magnetic field: magnetic induction, magnetic force on a current carrying conductor, torque on a current carrying loop, Hall effect, Faradays law of electromagnetic induction, Lenz's law, self induction, mutual induction; magnetic properties of matter; hysteresis curve; electromagnetic oscillation: L-C oscillations and its analogy to simple harmonic motion.

Modern Physics : Michelson-Morley's experiment, Galilean transformation, special theory of relativity and its consequences; quantum theory of radiation; photo-electric effect, Compton effect, wave particle duality, interpretation of Bohr's postulates, radioactive disintegration, properties of nucleus, nuclear reactions, fission, fusion, chain reaction, nuclear reactor.

Title	Code	Semester/Duration	Credits
CHEMISTRY-II;	CHEM-126	2/Longitudinal	3,0,3

CHEM126 Chemistry II (3,0,3)

Volumetric analysis: acidimetry-alkalimetry; titrations involving redox reactions, determination of Cu, Fe and Ca volumetrically; determination of Ca and Mg in water. Reaction kinetics: rate of chemical reactions; order and molecularity of reactions, different types of rate expressions, methods of determining rate and order, effect of temperature on reaction rate and energy of activation.

Title	Code	Semester/Duration	Credits
MATHEMATICS-III: ENGINEERING MECHANICS-STATICS	MATH-127	2/Longitudinal	3,2,0

Vector operations. Equilibrium of a particle. Free body diagram. Moment of forces about a point and about an axis. Equivalent systems. Equilibrium of a rigid body in two and three dimensions. Trusses (method of Joints and sections) . Frames and machines. Dry friction

Title	Code	Semester/Duration	Credits
MATHEMATICS-IV: DIFFERENTIAL EQUATIONS	MATH-211	3/Longitudinal	2,2,0

Ordinary differential equation: formation of differential equations; solution of first order differential equations by various methods; solution of differential equation of first order but higher degrees; solution of general linear equations of second and higher orders with constant co-efficient; solution of Euler's homogeneous linear differential equations.

Partial differential equation: introduction, linear and non-linear first order differential equations; standard forms; linear equations of higher order; equations of the second order with variable coefficients.

Title	Code	Semester/Duration	Credits
INTRODUCTION TO CIVIL ENGINEERING	CE-212	3Longitudinal	2,0,0

Historical background, present status and future challenges of civil engineering profession. Ethics and professional responsibilty. Written and oral communication. Concepts of analysis, design, computational approaches, experiments. Interpretation of results and decision making. Invited lecturers. Site visits.

Title	Code	Semester/Duration	Credits
MECHANICS OF MATERIAL-I	CE-213	3/Longitudinal	2,2,2

Concepts of stress and strain, constitutive relationships; deformations due to tension, compression and temperature change; beam statics: reactions, axial force, shear force and bending moments; axial force, shear force and bending moment diagrams using method of section and summation approach; elastic analysis of circular shafts, solid noncircular and thin walled tubular members subjected to torsion; flexural and shear stresses in beams; shear centre; thin walled pressure vessels. Tension, direct shear and impact tests of mild steel specimen

Title	*Code*	*Semester/Duration*	*Credits*
CIVIL ENGINNERING DRAWING –I	CE-214	3/Longitudinal	4+4

Lines and lettering; plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, parabola, hyperbola; solid geometry: concept of isometric view and oblique view, theory of projections; drawing of isometric view of 3d objects such as cube, prism, pyramid, cone and cylinder; projections of cube, prism , cone, cylinder; developments

Title	Code	Semester/Duration	Credits
ENGINEERING GEOLOGY	MISS-215	3/Longitudinal	3,0,0

Introduction to Geology: The Earth as a planet, Process of external and internal origin (Volcanic, Metamorphic, Sedimentary). Importance of Geology for Civil Engineering Projects: Physical properties and identification of common rock forming minerals. Rocks formation and classification: a. According to the mode of occurrences b. According to the Silica contents . Weathering and Erosion: Weathering classification: fresh, slightly weathered, moderately weathered etc. Formation of Meanders. Cycle of Erosion. Discontinuity classification: Joints, faults and other fractures, micro structural features: lamination, cleavages, and foliations. Spacing of discontinuities: close, wide, medium etc., Folds, unconformities. Effects of folding, faulting and jointing on civil engineering projects and their recognition in the field. Description of Rock masses as thickly bedded or thinly bedded: Identification of filling in joints: sand, clay and breccias etc. colour of grains, description with respect to the rock colour, identification as a coarse grained, hardness classification. Geological classification and identification of Rocks by geological names: Identification and subordinate constitutions in rock samples such as seams or branches of other types of minerals for example, Dolomite, Lime stone, Calcareous sand stone, sand.Classification of Durability of Rocks in Dry and wet condition with durability test:Engineering and physical properties of rocks. Geological technical properties of rocks used as building stones, as decorative stones and as industrial rocks such as colour, luster, streak, specific gravity, water absorption and unit weight etc.

Brief Introduction to structural Geology: Plate Tectonics with respect to theglobal application, earthquakes, causes of earthquakes, protective measures against earthquakes zoning of earth quakes, Seismic Waves, Classification of Earthquakes, Earthquake Intensity Scales (modified Mercalli Scale), Geology of Aquifers, Wells, Springs and Ground Water Conditions. Role of geology in selection of sites for dams, reservoirs, tunnels,ports/ harbors and other civil engineering structures: Land Slides: Definition, Causes of land Slides, Types of Land Slides,Protective Measures for Land Slides, Engineering Considerations. Glaciers and Glaciations: Origin of Glacial Ice, Types of Glaciers, Movement

of Glaciers, Glacial Erosion, Engineering Considerations. Volcanoes: Formation of Volcanoes, Types of Volcanoes, Nature and Types of Eruption, Products of Eruptions, Engineering Considerations. Brief introduction of local geology

Title	Code	Semester/Duration	Credits
ENGINEERING SURVEYING	CE-216	3/Longitudinal	3,2,0

Introduction: Introduction to land surveying, definitions of basic surveying terms, branches and their application. Instruments used. Techniques: Distance measurement

techniques, Theodolite and its Types,

Traversing and Triangulation, Tachometry, Plane Table Surveying. Computation of areas and volumes by various methods. Modern Methods in Surveying: Principles of EDMI Operation, EDM Characteristics, Total Stations, Field procedures for Total Stations in Topographic Surveys, Construction layout using Total Stations. Leveling and Contouring: Reduction of levels, adjustments of levels, precise leveling. UMethods Uand applications of contouring.

Surveying Drafting and Computations: Maps and Plans, Plotting, Contour Maps, Profiles, Cross- sections, Prismoidal formula, Computations of area and volumes by graphical analysis and use of surveying software.

Field Work: Horizontal and Vertical control, Construction Surveys, Railways, Highways, Pipelines and other infrastructures. Layout of buildings and structures.

Title	*Code*	*Semester/Duration*	*Credits*
MATHEMATICS-V: NUMERICAL METHODS	MATH-221	4Longitudinal	2,2,0

Solution of Non-Linear Equations: Simple interaction, Bisection method, Newton's method, Secant method, Method of false position.Finite Differences: Finite differences, Difference operators and tables,Differences of polynomials, Newton's and Gauss interpolating techniques forequally spaced data, Simple theorems on divided differences, Newton's formula for unequal intervals, Lagrange's formula of interpolation, Numerical differentiation. Numerical Integration: Review of integration concept and their physical significance for Engineering, Trapezoidal and Simson's rule numerical integration techniques. Solution of Linear Simultaneous Equations: Jacobi's method, Gauss-Settle method, Sparse matrices, Solution of differential equations, Euler and modified Euler methods, Runge Kutta and Kutta Merson methods. Complex Variables: Limit, continuity, zeros and poles, Cauchy-Reimann Equations, Conformal transformations, contour integration.

Title	*Code*	*Semester/Duration*	*Credits*
MECHANICS OF MATERIAL-II	CE-222	4/Longitudinal	2,2,2

Symmetric and unsymmetric bending of beams; stress transformation, failure criteria; beam deflection by direct integration and moment area method; buckling of columns; elastic strain energy and external work; cable and cable supported structures; bolted, riveted and welded joints.

Title	*Code*	*Semester/Duration*	*Credits*
CIVIL ENGINEERING DRAWING II	CE-223	4/Longitudinal	2,4,0

An introduction in graphical engineering which cover graphical technique and technical drawing principle in order preparing civil engineering drawing. Computer usage in drawing and detailing, Basic CAD practices, Basic AutoCAD usage.

Title	Code	Semester/Duration	Credits
INTRODUCTION TO GEOTECHNICAL ENGINEERING	CE-224	4/Longitudinal	2,0,0

based on origin and strength. We
mineralogical composition of soils. rocesses. Origin and porte
Residual and trans dentification of soil minerals.

Title	Code	Semester/Duration	Credits
BASIC ELECTROMECHANICAL ENGINEERING- ELECTRICAL ENGINEERING COMPONENT	MISS-225	-	4,2,0

Electrical Elements and Circuits: Electric current, voltage, power and energy, Ohm's law, inductance, capacitance, Kirchoff's laws. Introduction to node voltage and loop current methods, AC single and poly-phase system, DC machines, AC Synchronous Machines, AC Induction Machines, Transformers, Converting Machines.

Power Plant Installations and Distribution System: Power Systems layout, generation, transmission, distribution and utilization of electric power, Introduction to domestic electrification.

Electronics: Diode. Transistor and simple rectifier circuit. Principles of House wiring and Industrial wiring, Illumination. Electrical know how related to experimental design instrumentations like corrosion rate measurements, strain guages, LDT's, LVDT's. etc.

Title	Code	Semester/Duration	Credits
ENGINEERS IN SOCIETY	MISS-226	-	1,0,0

Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behaviour, code of engineering ethics, responsibilities of professional engineer, professional behaviour. Basics of law for engineers: introduction to Sudanese legal system, law of contract, industrial law, intellectual property law .etc.

Title	Code	Semester/Duration	Credits
STRUCTURAL ANALYSIS-I	CE-311	5/Longitudinal	3,2,0

Basic principles. Analysis of statically determinate trusses, beams, frames, arches, suspension cables. Influence lines for statically determinate structures. Deflection of structures. Buckling of columns.

Title	*Code*	*Semester/Duration*	*Credits*
ENGINEERING PROPERTIES OF SOIL & MEASUREMENTS	CE-312	5/Longitudinal	2,0,2

Laboratory Measurements of: Moisture density relationship, Classification and identification of soil, Grain size analysis, Compaction characteristics, Permeability, Consolidation, Shear strength. Associated laboratory experiments.

Title	Code	Semester/Duration	Credits
CONSTRUCTION ENGINEERING	CE-313	5/Longitudinal	2,0,0

Construction Planning and Practices. Utilization of heavy construction equipment. Economic and operational considerations in selection of construction equipment. Use of computer spreadsheets for cost recording and economic decisions. Quality and productivity control

Title	Code	Semester/Duration	Credits
CONCRETE TECHNOLOGY	CE-314	5/Longitudinal	2,0,2

Introduction to concrete; component materials for concrete (cement, aggregates, water, chemical admixtures, mineral admixtures); properties of materials, tests on materials; production processes of concrete, tests on fresh concrete; concrete mix design; tests on hardened concrete, properties of hardened concrete, strength, deformation, durability.

Title	Code	Semester/Duration	Credits
FLUID MECHANICS FOR CIVIL ENGINEERS	CE-315	5/Longitudinal	3,0,2

Introduction to fluid properties and characteristics, static fluid, forces in fluid, fluid kinematics, continuity equation and its application, momentum equation and its application, Bernoulli and energy equation and their application, boundary layers, lift and drag forces and their application, flow measurement. Related laboratory Experiments.

Title	Code	Semester/Duration	Credits
ADVANCED ENGINEERING SURVEYING	CE--316	5/Longitudinal	3,2,0

Hydrographic Surveys: Objectives of hydrographic survey and electronic charting, Vertical control, Depth and Tidal measurements, Position-fixing techniques, Sounding plan, Horizontal control, Processing.

Control Surveys: Geodesy, UTM and other Map Projections, Coordinate Systems and Datum, Horizontal control techniques, Survey markers, Observations on Polaris, Computation technique for azimuth determination and Gyro-theodolite.

Surveying Application: Highway and Railway Curves, Route surveys, Circular curves, Setting out circular curve by various methods, Compound curves, Reverse, Vertical, Parabolic curves, Design considerations, Spiral curves, Approximate solution for spiral problems, Super-elevation.

Title	Code	Semester/Duration	Credits

REINFORCED CONCRETE DESIGN-I	CE-321	6/Longitudinal	3,2,0

Introduction to properties of concrete and reinforcing steel. Behaviour of reinforced concrete under flexure and shear. Introduction to ACI-Code. Types of loads and their factors. Ultimate strength method of design. Analysis and design of singly and doubly reinforced sections. Analysis and design of T-section. Design of beams against shear forces. Design of one-way slab and stairways. Development length. Design of isolated, combined and wall footings.

Title	*Code*	*Semester/Duration*	*Credits*
CONSTRUCTION MANAGEMENT	CE-322	6/Longitudinal	2,0,0

Construction planning, scheduling, and control. Use of computer-based information systems for project management. Value engineering. Critical path method and PERT scheduling techniques. Computer drawn scheduling networks. Schedule compression. Resource allocation leveling and optimization. Project organization and financial control. Decision making.

Title	*Code*	*Semester/Duration*	*Credits*
HYDRAULICS	CE-323	5/Longitudinal	3,0,2

Pipe flow analysis and design. Steady flow in closed conduits and networks. Steady uniform flow in open channels. Non-uniform flows in open channels. Flow measurements. Hydraulic machinery (i.e. Pumps and hydraulic turbines), urban storm drainage, Hydraulic structures, Computer simulation and analysis. Related laboratory Experments.

Title	*Code*	*Semester/Duration*	*Credits*
COMPUTER PROGRAMMING	COMP-324		1,2,0

Computer organization and hierarchy of programming language, Fortran 90 as a high-level language, arithmetic computations, algorithm design, selection statements, repetition statements, debugging and testing of programmed, logical and character data type, data files and formatted outputs, array processing, subprogrammed, introduction to derived data types and structures, numerical applications.

Title	*Code*	*Semester/Duration*	*Credits*
MATHEMATICS-6	MATH-325	6Longitudinal	2,2,0

Statistics: measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions, e.g. normal and exponential distribution of cube, pyramid, cone, cylinder; plan, elevations and sections of one storied and duplex

building.

Slender column test; static bending test; hardness test of metals; helical spring test; determination of shear centre; study of structural models: truss, beam frame.

Title	Code	Semester/Duration	Credits
REMOTE SENSING	CE-326	6/Longitudinal	2,2,0

Introduction to the basic for GPS and GIS applications; Geodesy: introduction, the ellipsoid and geoids, geodetic position , geoids undulation ,deflection of the vertical, geodetic coordinate system ; Map Projection : projections used in state plane coordinate systems, UTM projection; GPS : overview of GPS, differential GPS, GPS static survey, GPS kinematic survey; GIS: introduction to GIS, GIS data sources and data format, creating GIS databases, GIS applications, use of surveying software such as GeoMedia and Leica Geo Office).

Title	Code	Semester/Duration	Credits
STRUCTURAL ANALYSIS-II	CE-411	7/Longitudinal	3,2,0

Analysis of statically indeterminate structures by method of consistent deformations. Method of slope-deflection and moment distribution. Influence lines for statically indeterminate structures. Approximate methods of analyze of multi-sections forms.

Title	Code	Semester/Duration	Credits
SOIL MECHANICS	CE-412	7/Longitudinal	2,0,2

Seepage theory, soil stresses using elastic theory, Immediate settlement, Total and effective stress principle, consolidation settlement and its rate, Shear strength, Lateral earth pressure, Slope stability, Excavation and bracing. . Associated laboratory experiments.

Title	Code	Semester/Duration	Credits
ENGINEERING ECONOMICS	CE-413	7/Longitudinal	2,0,0

Economics and engineering; microeconomics and macroeconomics; theory of demand and supply and their elasticities; demand estimation; price determination; indifference curve technique; theory of production; theory of cost and cost estimation; market structure; national income accounting, depreciation; circular flow of income and expenditure; costbenefit analysis; pay back period, NPV, IRR, inflation; economic feasibility of engineering undertakings.

Title	Code	Semester/Duration	Credits

HYDROLOGY & WATER RESOURCES ENGINEERING	CE-414	7/Longitudinal	2,0,0

Principles of Hydrology and Water Resources Engineering. Objectives of water resources development. Water demand. Hydrologic cycle. Measurement and analysis of precipitation, evaporation, infiltration and stream flows. Water balance. Reservoirs, Dams and Spillways. Conjunctive use of surface and groundwater. Planning for water resources development. Economical analysis of water resources projects.

Title	*Code*	*Semester/Duration*	*Credits*
DESIGN OF STEEL STRUCTURES	CE-415	8/Longitudinal	3,2,0

Design of steel structures, material properties of steel. Allowable stress design approach. Introduction to Eurocodes. Connections, tension members, compression members, beam-columns. Beams and girders. Design of frames, trusses and industrial buildings.

Title	*Code*	*Semester/Duration*	*Credits*
DYNAMICS OF STRUCTURE	CE-416	7/Longitudinal	2,2,0

Single degree of freedom system, formulation of equation of motion; free vibration response; response to harmonic, impulse and general dynamic loading; vibration analysis by Rayleigh's method; response spectra; two degrees of freedom system.

Title	*Code*	*Semester/Duration*	*Credits*
REINFORCED CONCRETE DESIGN-II	CE-421	8/Longitudinal	3,2,0

Review ACI/Euro- Code provisions. Design of Continuous Beams and Frames: Continuity of reinforced concrete structures, load combinations. Design of Two-way slabs: Edge supported vs. column supported slab systems (DDM). Design of rectangular and circular Reinforced Concrete Columns. Axially and eccentrically loaded columns. interaction diagrams. Slender columns and biaxial bending.

Title	*Code*	*Semester/Duration*	*Credits*
TRANSPORTATION ENGINEERING	CE-422	8/Longitudinal	3,2,0

Transportation as a system; human and vehicle characteristics; traffic flow characteristics; highway capacity analysis; highway control devices; public transportation; urban transportation planning; parking facilities; transportation safety; intelligent transportation system and computer applications; introduction to railway, waterway, airport and pipeline.

Title	*Code*	*Semester/Duration*	*Credits*

ENVIRONMENTAL ENGINEERING	CE-423	8/Longitudinal	2,2,0

Water supply sources, transmission, water distribution reservoirs and networks; wastewater collection and disposal; introduction to water and wastewater treatment methods.

Title	*Code*	*Semester/Duration*	*Credits*
ENVIRONMENTAL ENGINEERING	CE-423	8/Longitudinal	2,2,0

Groundwater in hydrologic cycle and its occurrence. Physical properties and principles of groundwater movement. Groundwater and well hydraulics. Groundwater resource evaluation.

Groundwater levels and environmental influences. Water mining and land subsidence. Groundwater pollution and contaminant transport.

Recharge of groundwater. Saline water intrusion in aquifers.

Groundwater management

Title	*Code*	*Semester/Duration*	*Credits*
FOUNDATION ENGINEERING	CE-425	8/Longitudinal	2,2,0

Application of soil mechanics and other related techniques to design of foundations. Methods of site and soil exploration; bearing capacity and settlements; shallow and deep foundations; bracing and retaining structures. Case studies

Title	*Code*	*Semester/Duration*	*Credits*
STRUCTURAL ANALYSIS- III	CE-511	9/Longitudinal	3,20

Energy methods in structural mechanics. Matrix method of structural analysis. Flexibility and stiffness methods. Elastic instability. Limit state analysis of frames.

Title	*Code*	*Semester/Duration*	*Credits*
HIGHWAY DESIGN AND CONSTRUCTION	CE-512	9/Longitudinal	3,2,0

Characteristics of driver, pedestrian vehicle, and traffic flow affecting highway design; Geometric design of highways; Layouts of intersections, interchanges and terminals; Highway drainage; Review of highway paving materials; Design of asphalt paving mixtures; Pavement design; Highway construction and supervision; categorization of common pavement surface distress and associated correction activities; Introduction to maintenance management system; Computer

Title	*Code*	*Semester/Duration*	*Credits*

DESIGN OF HYDRAULIC STRUCTURE	CE-513	9/Longitudinal	2,2,0

Types. Advantages and functions of hydraulic structures. Flow through orifices. Culverts. Under gates. Over weirs and spillways. Energy dissipation below hydraulic structures. Hydraulic design of culverts. Weirs. Spillways. Aqueducts. Syphons. Regulators and dams. Computer applications

Title	*Code*	*Semester/Duration*	*Credits*
ENVIRONMENTAL ENGINEERING DESIGN	CE-514	9/Longitudinal	2,2,0

Water purification processes in natural systems; eutrophication; engineered systems for water purification such as filtration within enviromental and civil engineering context; enviromental engineering hydraulics design. applications on highway geometric design.

Title	*Code*	*Semester/Duration*	*Credits*
QUANTITY SURVEYING & ESTIMATION	CE-515	9/Longitudinal	2,2,0

Scope: Scope of civil engineering works; General practice in government departments for schedule of rates and specifications; Rate analysis; Specifications for various items of construction.

Bill of Quantities (B.O.Q) & Measurement Book (M.B): Types and methods of estimates, Working out quantities, rates and cost analysis of construction materials; Valuation, depreciation and sinking fund.

Contents and preparation of bills of quantities for different projects like irrigation, roads, sanitary, building etc. and maintaining of Measurement Books. Measurement, specification and costing of excavation and back filling, mass concrete retaining walls, beams, concrete piles, steel or wooden truss or steel framed gantry, estate road, sewer and water main pipe works, Priced bill of quantity.

Tendering: Preparation of civil engineering contracts and tender documents. Introduction to claims and conflicts resolution e.g. escalation, indexation, arbitration and litigation.

Evaluation of proposals and contracts.

Title	*Code*	*Semester/Duration*	*Credits*
GRADUATIO PROJECT-1	CE-516	9/Longitudinal	0,3,0

This is the first phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the civil engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work,

computational studies, simulation, and implementation. Students will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of Semister 2.

Title	Code	Semester/Duration	Credits
IMPROVEMENT OF GEOTECHNICAL MATERIALS	CE-521	10/Longitudinal	2,2,0

Improving performance of soils for engineering applications. Analysis of methods of stabilizing soils and rocks including topics on: Mechanical and chemical stabilization and earth reinforcement.

Title	Code	Semester/Duration	Credits
COMPUTER AIDED DESIGN OF STRUCTURES	CE-522	10/Longitudinal	0,4,0

Computers in Engineering. Computernputer programming methods. Matrix language and co aided design of slabs,algebra. Computer-
beams and columns.

Title	Code	Semester/Duration	Credits
BRIDGE DESIGN	CE-523	10/Longitudinal	3,2,0

Superstructure and substructure design. Design of simple span and continuous span bridges, including slab, beam and truss types. Introduction to orthotropic steel plate deck bridges. Suspension bridges.

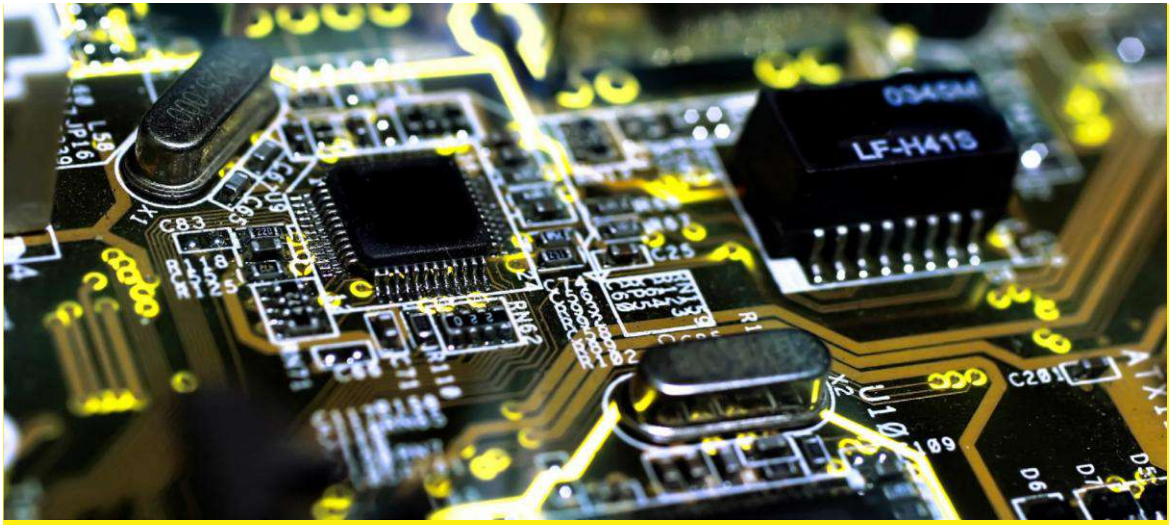
Title	Code	Semester/Duration	Credits
ELECTIVE I: FROM CE DEPARTMENT	CE-524	10/Longitudinal	0,0,3

Title	Code	Semester/Duration	Credits
ELECTIVE II: FROM CE DEPARTMENT	CE-525	10/Longitudinal	0,0,3

Title	Code	Semester/Duration	Credits
GRADUATION PROJECT-II	CE-526	10/Longitudinal	0,3,0

This is the implementation phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different

aspects of the civil engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of the Semister.



PART - 2
Electric & Electronic Engineering [B.Sc]

VISION AND MISSION

The VISION of this Department is to impart education leading to become highly competent professional in Electrical & Electronics Engineering who will excel in meeting the challenges to serve the society.

The MISSION is to enhance the position of the EEE Department as one of the top teaching and research departments in Sudan by providing the highest quality teaching and learning environment for the students and thus producing the competent and compassionate EEE graduates fully equipped to achieve the highest personal and professional standards for the overall development of the university and of the country. Moreover, the Department is dedicated to attracting and sustaining a cluster of faculty members who are, through their quality teaching, research and service, devoted to the development of compassionate EEE graduates.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Engineering, has to:

1. Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry, and computer or engineering sciences. International students who have not studied Arabic and religious studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.
3. Apply electronically though the website of the Admission and Accreditation Office, Ministry of Higher

Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Engineering - .

4. Pay the published fees: 15,000 SDG or US $ 3,500 [international students]

CAREER ADVICE

The Sudanese graduate with Faculty of Engineering with B.Sc (EEE) aquires a unique mix of electrical, electronics and computer related courses enabling the students to take-up a professional career / higher studies in any of these areas. Broad range of topics covered includes Electrical Circuits, Electrical Machines, Control Systems, Measurements & Instrumentation, Power Generation, Distribution & Transmission, Analog & Digital System Design, Power Electronics, Microprocessors, Computer Architecture, Data Structures, Digital Signal Processing, Communication Systems, Renewable Energy Systems and Illumination Technology etc. The curriculum will be updated periodically to reflect changes in the Electrical & Eltronic Engineering profession in consultation with experts from industries and other renowned academic institutions. The graduate can go in any one of the above areas, and be immediately enrolled in jobs. A graduate may choose to obtain masters or PhD in the subspecialties of civil engineering. International students are allowed to take engineering jobs in Sudan

FACULTY OBJECTIVES

The objectives of the National University Faculty of Engineering - Electric and Electronic Department are to:

1. Ensure that graduates will have a mastery of fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities necessary for entering EE engineering career and/or higher studies.
2. Produce graduates that have the knowledge and skills necessary for identifying and assessing design alternatives and the related social, economic, environmental, and public safety impacts.
3. Produce graduates who have verbal and written communication skills necessary for successful professional practice.
4. Prepare graduates to function effectively on teams.
5. Prepare graduates to deal with ethical and professional issues, taking into account the broader societal implications of Electric and Electronic engineering.
6. Prepare graduates for professional careers, leadership roles and life-long learning.

Curriculum Objectives [Characteristics of the Electric and Electronic engineering graduate A graduate of the National University- EE Curriculum should be able to:

1. Show ability to apply knowledge of mathematics and science fundamentals inEE engineering.
2. Act as competent professional with good communication skills and a desire with good knowledge in Electrical & Electronics Engineering.
3. Demonstrate the skills to design and conduct experiments, as well as to analyze and interpret data.
4. Show ability to design a system, component, or process to meet desired needs.
5. Present attitudes to function on multi-disciplinaryteams.
6. Identify, formulate and solve engineering problems.
7. Show understanding of professional and ethical responsibility.
8. Communicate effectively.
9. Discuss the impact of EE engineering solutions in a global and societal context.
10. Recognize the need for, and an ability to engage in life-long learning
11. Show awareness of contemporaryissues.
12. Use, skillfully the techniques, skills, and modern engineering tools necessary for EE engineering practice.
13. Plan, design, construct, maintain, and operate of large and permanent engineering projects of our civilization
14. Design, develop, test, and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems, and power generation equipment.
15. Design and develop electronic equipment, such as broadcast and communications systems—from portable music players to global positioning

systems (GPS).

16. Discuss the major subdivisions of EE engineering.

17. Engage in postgraduate studies and research to contribute to knowledge expansion.

TIMETABLE

The student has to earn 183 credit hours to obtain a B.Sc. degree in Electrical & Electronic Engineering e. The study programme for BSc students in the Electrical & Electronic Engineering Department is distributed over 10 semesters as follows:

Semester 1 [22 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Physics I	PHY111	2	1	2	3
2	Chemistry	CHM 111	2		3	3
3	Engineering Mechanics I (Statics)	MAT 113	2	2		3
4	Calculus I	MAT111	2	2	-	3
5	Linear Algebra	MAT 112	2	2		3
6	English Language I	ENL111	3	-	-	3
7	Engineering Drawing I	GEN 121	1	3		2
8	Sudanese Culture	SCL111	2	-	-	2
			16	10	5	22

Semester 2 [21 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Analytic Geometry	MAT 122	2	2		3
2	Engineering Mechanics II (Dynamics)	MAT 123	2	2		3
3	Introduction to Computer	COM111	1	-	2	2
4	English Language II	ENL121	2			3
5	Physics II	PHY 121	2	1	2	3
6	Calculus II	MAT 121	2	2		3
7	Engineering Drawing II	GEN 121	1	3		2
8	Fundamentals of Engineering	GEN122	2	-	-	2
			14	10	4	21

Semester 3 [18 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
tial Equations	MATH211	2	3	-	3
entals of Electric Circuits	EE212	3	2	-	4
agnetics I	EE213	3	2	-	4
tion to Electrical Systems and ations	EE214	2	-	2	3
Circuits Laboratory	EE215	-	-	2	1

er Aided Electrical Draw ing I	EE216	2	-	3	3
		13	8	5	18

Semester 4 [18 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
cal Methods	MATH221	2	2	-	3
magnetics II	EE222	4	2		4
esign	EE223	2	1	2	3
Logic Lab	EE224	-	-	2	1
er Aided Electrical Draw ing II	EE225	2	-	3	3
al Circuit Analysis	EE226	3	1	-	3
ction to Electrical Engineering	EE227	1	-	-	1
		14	6	7	18

Semester 5 [18 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
and Digital Electronic Circuits	EE311	3	-	-	3
and Analog Electronic Circuits ory	EE312	-	-	3	1
nic Devices	EE313	3	-	-	3
nic Devices Laboratory	EE314	-	-	3	1
and System Analysis	EE315	3	3		4
al Instruments and Measurements	EE316	3	1		3
al Instruments and Measurements	EE317	-	-	2	1
oriented programming and data es	EE318	1	-	3	2
		13	4	11	18

Semester 6 [17 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
	MATH321	2	2	-	3
croprocessors	EE322	3	-	-	3
Lab	EE323	-	-	2	1
Principles	EE324	3	2	-	4
Laboratory	EE325	-	-	4	2
Pow er Systems	EE326	3	2	-	4
		11	6	6	17

Semester 7 [17 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
agement and society	EE411	3	-	-	3
gn	EE412	3	-	-	3
gn Lab	EE413	-	-	3	1
ations	EE414	3	2	-	4
cessing	EE415	3	2	-	4
	EE416	3	1	-	3
		14	3	8	17

Semester 8 [17 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
nce and marketing	EE421	3	-	-	3
ol	EE422	3	1	-	3

utomatic Control Lab.	EE423	-	-	3	1
ntenna Theory and Design	EE424	3	-	3	4
ectromechanical Energy Conversion	EE425	3	1	2	4
omputer Science for EE Students	EE426	2	1	-	2
		14	3	8	17

Semester 9 [17 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
Frequency Electronics	EE511	2	1	-	2
ced Electronic Circuits	EE512	3	1	-	3
nications Systems	EE513	3	1	-	3
ction to Artificial Intelligence	EE514	2	-	-	2
mechanical Energy Conversion II	EE514	2	-	2	3
ation Project –I	EE516		6		3
		13	9	2	17

Semester 10 [18 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
nication Networks	EE521	3	1		3
ter network security	EE522	3	1		3

mmable Logic Controllers	EE523	2	-	3	3
e from EE Dept	EE 524	3			3
E Dept	EE 525	3			3
ect –II	EE526		6		3
		14	8	3	18

COURSE OUTLINES

Title	*Code*	*Semester/Duration*	*Credits*
PHYSICS-I	PHYS-114	1/Longitudinal	3,0,3

Physical optics: theories of light; Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference at wedge shaped films, Newton's rings, interferometers; diffraction of light; Fresnel and Fraunhoffer diffraction, diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and n-slits-diffraction grating; polarization; production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction, retardation plates, nicol prism, optical activity, polarimeters, polaroid.

Waves and oscillations: differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Lissajous figures, spring-mass system, calculation of time period of torsional pendulum, damped oscillation, determination of damping co-efficient; forced oscillation, resonance, twobody oscillations, reduced mass, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.

Heat and thermodynamics: principle of temperature measurements: platinum resistance thermometer, thermoelectric thermometer, pyrometer; kinetic theory of gases: Maxwell's distribution ofmolecular speeds, mean free path, equipartition of energy, Brownian motion, Vander Waal's equation of state, review of the first law of thermodynamics and its application, reversible and irreversible processes, second law of thermodynamics, Carnot cycle; efficiency of heat engines, Carnots theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, third law of thermodynamics.

Title	Code	Semester/Duration	Credits
CHEMISTRY	CHEM-115	1/Longitudinal	3,0,3

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger's wave equation, electronic configurations and properties of atoms; electronic configurations and properties of molecules: chemical bond, valence bond theory molecular orbital theory, shape of molecules, bond length, bond energy; chemistry of halogen, alkali metals, alkaline earth metals, non-metals and heavy metals; modern concepts of acids and bases; different types of solutions; properties of dilute solution; thermochemistry; electrochemistry: voltaic cells, electrolytic cells; colloids and colloidal solution; chemical and ionic equilibria; chemistry of water; chemistry of water pollution; chemistry of cements, silicates and limes.

Title	Code	Semester/Duration	Credits
DIFFERENTIAL AND INTEGRAL CALCULUS; MATRICES	MATH-117	1/Longitudinal	3,3,0

Differential calculus: limit, continuity and differentiability; successive differentiation and Leibnitz's theorem; expansion of functions; indeterminate forms; partial differentiation; Euler's theorem; tangent and normal; maxima and minima of functions of single variables. Integral calculus: integration by parts; standard integrals; integration by the method of successive reduction; definite integrals; beta function; gamma function; multiple integrals.

Matrices: definition of different kinds of matrices; algebra of matrices; inverse of matrix; rank and elementary transformation of matrices; solution of system of linear equations; Eigen values and Eigen vectors; CayleyHamilton theorem.

Title	Code	Semester/Duration	Credits
VECTOR ANALYSIS	MATH-118	1/Longitudinal	2,2,0

Vector analysis: scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence and independence of vectors; definition of line, surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications.

Title	Code	Semester/Duration	Credits
PHYSICS-II	PHYS-125	2/Longitudinal	3,0,3

Structure of matter : crystalline and non-crystalline solids, single crystal and polycrystal solids, unit cell, crystal systems, coordinations number, crystal planes and directions, NaCl and CsClstructure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's law, methods of determination of interplanar spacing from diffraction patterns; defects in solids: point defects, line defects, bonds in solids, interatomic distances, calculation of cohesive and bonding energy; introduction to band theory: distinction between metal, semiconductor and insulator.

Electricity and magnetism: Coulomb's law, electric field (E), Gauss's law and its application, electric potential (V), capacitors and capacitance, capacitors with dielectric, dielectric and atomic view, charging and discharging of a capacitor, Ohm's law, Kirchoff's law; magnetic field: magnetic induction, magnetic force on a current carrying conductor, torque on a current carrying loop, Hall effect, Faradays law of electromagnetic induction, Lenz's law, self induction, mutual induction; magnetic properties of matter; hysteresis curve; electromagnetic oscillation: L-C oscillations and its analogy to simple harmonic motion.

Modern physics: Michelson-Morley's experiment, Galilean transformation, special theory of relativity and its consequences; quantum theory of radiation; photo-electric effect, Compton effect, wave particle duality, interpretation of Bohr's postulates, radioactive disintegration, properties of nucleus, nuclear reactions, fission, fusion, chain reaction, nuclear reactor.

Title	*Code*	*Semester/Duration*	*Credits*
PROGRAMMING IN C	COMP-126	2/Longitudinal	2,0,2

Introduction to computers and computing fundamentals, programme structure, variables and arithmetic operations, data formatting and input/output, relational and logical expressions, IF-ELSE control structure, WHILE statement, FOR statement and looping structures, Functions and modular programming, numeric 1-D and 2-D arrays, strings and pointers, applications in electrical engineering.

Title	*Code*	*Semester/Duration*	*Credits*
ENGINEERING MECHANICS-STATICS	MATH-127	2/Longitudinal	2,2,0

Vector operations. Equilibrium of a particle. Free body diagram. Moment of forces about a point and about an axis. Equivalent systems. Equilibrium of a rigid body in two and three dimensions. Trusses (method of Joints and sections) . Frames and machines. Dry friction

Title	*Code*	*Semester/Duration*	*Credits*
DIFFERENTIAL EQUATIONS	MATH-211	3/Longitudinal	2,2,0

Ordinary differential equation: formation of differential equations; solution of first order differential equations by various methods; solution of differential equation of first order but higher degrees; solution of general linear equations of second and higher orders with constant co-efficient; solution of Euler's homogeneous linear differential equations. Partial differential equation: introduction, linear and non-linear first order differential equations; standard forms; linear equations of higher order; equations of the second order with variable coefficients.

Title	*Code*	*Semester/Duration*	*Credits*
STATISTICS	MATH-325	6/Longitudinal	2,2,0

Statistics: measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions, e.g. normal and exponential distribution.

Title	*Code*	*Semester/Duration*	*Credits*
FUNDAMENTALS OF ELECTRICAL CURRICULA	EE-212	3/Longitudinal	3,2,0

Basic circuit elements and concepts; Basic laws of circuit theory: Ohm's law, Kirchoff's law; Circuit theorems: superposition principle, Thevenin and Norton theorems; maximum power transfer theorem Techniques of circuit analysis: Nodal and mesh analysis; Sinusoidal sources and the concept of phasor in circuit analysis; Introduction to concept of average, reactive, complex power and power factor.

Title	*Code*	*Semester/Duration*	*Credits*
ELECTROMAGNETICS-I	EE-213	3/Longitudinal	3,2,0

Review to vector calculus; Electrostatic fields; Gauss's law and divergence; Electric potential; Dielectrics and capacitance; Poisson's and Laplace's equations; Charge images; Current density and conductors; Magnetostatic fields; Biot–Savart and Ampere's laws; Curl and Stoke's theorem; Magnetic materials and circuits; Self and mutual inductances; Energy in static Fields.

Title	*Code*	*Semester/Duration*	*Credits*
INTRODUCTION TO ELECTRICAL AND COMPUTATIONS	EE-214	3/Longitudinal	2,0,2

Introduction to fundamentals of EE: circuits, energy, communication, control, signal processing, electromagnetics, electronics, and digital systems. Computational techniques. Instrumentation and measurement. Introduction to technology and applications.

Title	Code	Semester/Duration	Credits
ELECTRIC CIRCUITS LABORATORY	EE-214	3/Longitudinal	0,0,2

General introduction to the laboratory Voltage, current, and power in DC circuits using KVL and KCL. Superposition, Thevenin's, and Maximum power transfer theorems in DC circuits; Series and parallel AC circuits; Resonance in series and parallel circuit; Maximum power transfer theorem and power factor improvement in AC circuits; Transients in DC circuits; Magnetically-coupled circuits; Three phase circuits.

Title	Code	Semester/Duration	Credits
COMPUTER AIDED ELECTRICAL DRAWING-I	EE-216	3/Longitudinal	2,0,3

1. Winding Diagrams (a) Developed winding diagrams of D.C. machines – Simplex and multiplex double layer Lap and Wave windings. (b) Developed winding diagrams of A.C. machines (i) Integral and Fractional slot double layer Lap and Wave windings. (ii) Single layer windings – Un-bifurcated 2 and 3 tier windings, mush windings, Bifurcated 2 and 3 tier windings. 2. Single line diagrams of generating stations and substations.

Title	Code	Semester/Duration	Credits
NUMERICAL METHODS	MATH-221	4/Longitudinal	2,2,0

Solution of Non-Linear Equations: Simple interaction, Bisection method, Newton's method, Secant method, Method of false position. Finite Differences: Finite differences, Difference operators and tables,Differences of polynomials, Newton's and Gauss interpolating techniques forequally spaced data, Simple theorems on divided differences, Newton's formula for unequal intervals, Lagrange's formula of interpolation, Numerical differentiation. Numerical Integration: Review of integration concept and their physical significance for Engineering, Trapezoidal and Simson's rule numerical integration techniques. Solution of Linear Simultaneous Equations: Jacobi's method, Gauss-Settle method, Sparse matrices, Solution of differential equations, Euler and modified Euler methods, Runge Kutta and Kutta Merson methods. Complex Variables: Limit, continuity, zeros and poles, Cauchy-Reimann Equations, Conformal transformations, contour integration.

Title	Code	Semester/Duration	Credits
ELECTROMAGNITICS –II	EE-222	4/Longitudinal	3,1,0

Time varying fields; Faraday's law. Transformer and motional emfs; Displacement

current; Maxwell's equations and time harmonic fields; Wave equation; Power transfer and Poynting vector; Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence; Transmission lines; Impedance matching; Introduction to radiation and antennas; Antenna parameters; Wire antennas.

Title	*Code*	*Semester/Duration*	*Credits*
LOGIC DESIGN	EE-223	4/Longitudinal	2,1,2

Number systems; Boolean algebra and logic gates; Simplification of Boolean functions; Combinational logic circuits design and analysis; MSI and PLD components; Introduction to synchronous sequential logic; Flip flops; Analysis of clocked sequential circuits; State reduction and assignment; Design of synchronous sequential circuits and PLA's.

Title	*Code*	*Semester/Duration*	*Credits*
DIGITAL LOGIC LABORATORY	EE-224	4/Longitudinal	0,0,2

Familiarization with logic circuits laboratory; Introduction to logic gates; Implementation of Boolean functions using AND and OR gates; NAND and NOR implementation; XOR and adders; Design of combinational circuits; Flip-flops; Design of sequential circuits; Sequential PLA's.

Title	*Code*	*Semester/Duration*	*Credits*
ELECTRICAL CIRCUIT ANALYSIS	EE-226	4/Longitudinal	3,1,0

Frequency response of RLC and selective circuit: concept of transfer function, resonance, bode plots, introduction to filters; Two-Port networks; Mutual inductance and transformers; Transient analysis of first and second order circuits; Three phase circuits; Introduction to Op-Amp, ideal characteristics with simple applications; Diode characteristics, clipping and rectification.

Title	*Code*	*Semester/Duration*	*Credits*
COMPUTER AIDED ELECTRICAL DRAWING-II	EE-225	4/Longitudinal	2,0,3

Electrical machine assembly drawing using designs data or sketches or both. (a) Transformers - sectional views of single and three phase core and shell type transformers. (b) D.C. machine - sectional views of yoke, field system, armature and commutator dealt Separately. (c) Alternator – sectional views of stator and rotor dealt separately.

Title	*Code*	*Semester/Duration*	*Credits*
INTRODUCTION TO ELECTRICAL ENGINEERING	EE-227	4/Longitudinal	1,0,0

Historical background, Electrical engineering fields of activities, present status and future challenges of Electrical engineering profession. Ethics and professional responsibilty. Written and oral communication. Invited lecturers. Site visits.

Title	Code	Semester/Duration	Credits
DIGITAL AND ANALOG ELECTRONIC CIRCUITS LABORATORY	EE-310	5/Longitudinal	0,0,3

PSPICE simulation of electronic circuits. Linear applications of op-amp. Wein-bridge oscillator. Active filters: LPF, and HPF. Schmitt trigger and astable multivibrator. Differential amplifier using BJT. Design and implementation of digital circuits using VHDL. CMOS inverter characteristics. TTL inverter characteristics.

Title	Code	Semester/Duration	Credits
ANALOG AND DIGITAL ELCTRONIC CIRCUITS	EE-311	5/Longitudinal	3,0,0

Linear and nonlinear op-amp applications: inverting and non-inverting amplifiers, integrator, difference amplifier. Differential amplifier. Current Mirror. Negative and positive feedback. NMOS and CMOS inverters, CMOS and pseudo NMOS logic gates, pass-transistor logic, dynamic logic. BJT digital circuits: TTL, and ECL logic.

Title	Code	Semester/Duration	Credits
ELECTRONIC DEVICES	EE-313	5/Longitudinal	3,0,0

Intrinsic and doped semiconductors, drift and diffusion currents. PN junction diode: basic structure, I-V characteristics, large and small-signal models. Bipolar junction transistor (BJT): basic structure, modes of operation, dc biasing, dc and small-signal models, single stage BJT amplifiers. Field-effect transistors (FET): structure and operation of enhancement and depletion MOSFETs, I-V characteristics, dc biasing. Introduction to JFET.

Title	Code	Semester/Duration	Credits
ELECTRONIC DEVICES LABORATORY	EE-314	5/Longitudinal	0,0,3

Introduction to the lab tools, I-V characteristics of diode, clipping circuits using diodes, rectification using diodes, Zener diode and regulators, BJT DC biasing, CE BJT amplifier. MOSFET DC biasing, CS MOSFET amplifier, simple AM receiver circuit

Title	Code	Semester/Duration	Credits
SIGNAL AND SYSTEM ANALYSIS	EE-315	5/Longitudinal	3,3,0

Motivation and Applications, Signal Classifications, Signal Operations, Singularity

Functions; Linear timeInvariant Systems and Convolution; Correlation; Fourier Series and Transform for continuous and discrete time signals; Applications; Laplace transform and applications; Introduction to z-transform.

Title	Code	Semester/Duration	Credits
ELECTRICAL INSTRUMENTS AND MEASUREMENTS	EE-316	5/Longitudinal	3,1,0

Measurements fundamentals: units and standards, errors, statistical analysis; DC/AC meters construction; loading effect; insertion loss; Difference and instrumentation amplifiers; Oscilloscope: CRT, amplifiers, triggered sweep circuits, attenuation, specifications; Spectrum analyzer, Transducers and sensors: passive and selfgenerating transducers; Liquid crystal displays (LCDs), CCDs, and optical fiber sensors; Digital measurements: Data conversion principles; Digital voltmeter; Grounding, shielding, and noise.

Title	Code	Semester/Duration	Credits
ELECTRICAL INSTRUMENTS AND MEASUREMENTS LAB	EE-317	5/Longitudinal	0,0,2

Sample statistics; correlation of data, AC and DC bridges; Difference and instrumentation amplifiers, Rise-time measurement; Phase-shift measurement; Measurement of capacitance using oscillators; The photoconductive transducer; Phototransistor; Analog to Digital converters. The operational amplifier as an amplifier and integrator of DC and AC signals.

Title	Code	Semester/Duration	Credits
OBJECT-ORIENTED PROGRAMMING AND DATA STRUCTURE	EE-318	5/Longitudinal	1,0,3

This course aims to provide a hands-on and in depth survey of object oriented programming paradigm, and the basic concepts of data structures through the Java programming language. It serves to provide a solid foundation of essential concepts on object oriented programming and data structures.

Title	Code	Semester/Duration	Credits
INTRODUCTION TO MICROPROCESSORS	EE-322	6/Longitudinal	3,0,0

Microprocessors architecture; Addressing modes and techniques; Instruction set; Assembly language programming; Interrupt systems; Input/output devices and timing; Memory devices; Future trends in microprocessors.

Title	Code	Semester/Duration	Credits
MICROPROCESSOR LABORATORY	EE-323	6/Longitudinal	0,0,2

Introduction to microprocessors and their architecture; Microprocessor C/Assembly programming and machine code generation; RAM and EPROM; RS-232C; SCI and serial port interface; Parallel I/O interface and DMA; Programmable I/O interfaces and UART; DAC and ADC converters; Real time implementation; Project.

Title	Code	Semester/Duration	Credits
COMMUNICATION PRINCIPLES	EE-324	6/Longitudinal	3,2,0

Overview and Basic elements of Communication Systems; Signal Analysis; Transmission through Systems and Channels; Modulation; AM; Frequency Conversion; FM and PM; Superhetrodyne Receiver; FDM; Stereo Broadcasting; Sampling; Pulse Modulation (PAM, PWM, PPM); TDM; Pulse Code Modulation (PCM); DPCM and DM; Regenerative Repeaters; Advantages of Digital Communication; Line Coding (Binary Signaling); Introduction to Digital Modulation (ASK, FSK, PSK).

Title	Code	Semester/Duration	Credits
COMMUNICATIONS LABORATORY	EE-325	6/Longitudinal	0,0,4

AM and FM modulation and detection; PCM and delta modulation; Bit error rate measurements; TDM; ASK; FSK; Optical fiber parameter measurements; RF impedance measurements and matching; Basic propagation and antenna measurements.

Title	Code	Semester/Duration	Credits
FUNDAMENTALS OF POWER SYSTEMS	EE-326	6/Longitudinal	3,2,0

ion; Transmission line and cable para
and distribution lines; Electric insulators; Analysis of transmission stems; High
Grounding sy surges

Title	Code	Semester/Duration	Credits
DIGITAL SIGNAL PROCESSING	EE-360	6/Longitudinal	3,2,0

Review of discrete-time signals and systems; The Discrete-Time Fourier transform, Fast Fourier Transform, Z Transform, Recursive and no recursive digital filters design and realization; Decimation and interpolation; Applications of digital signal processing in communications

Title	Code	Semester/Duration	Credits
ENGINEERING MANAGEMENT AND SOCIETY	EE-411		03,00

The aims of Engineering Management and Society are to develop basic understanding of organization and management skills, Project Managemen, professional ethics and legal foundation for the engineering discipline. Topics on engineering organization, project management and managerial skills, decision making processes, contingency and crisis management, leadership, corporate culture and philanthropy will be discussed. In order to provide a clear and right insight for engineering students to interact and contribute to the society, topics related to professional conduct, social responsibility, sustainability and safety issues, technology and environment, professional ethics are included. For the legal foundation, topics such as contract, intellectual property, tort, professional negligence and related law issues are discussed.

Title	Code	Semester/Duration	Credits
VSLI CIRCUIT DESIGN-1	EE-412	7/Longitudinal	3,0,0

Basic fabrication sequence of ICs: self aligned silicon gate, NMOS and CMOS technologies. Design rules and layout. Combinational and sequential circuits. Memories and registers. Introduction to full custom and semicustom ICs, standard cells, gate arrays, FPGAs and PLDs etc. CAD tools for design of ICs. Introduction to high level design of ICs using VHDL. Introduction to low power IC design.

Title	Code	Semester/Duration	Credits
VLSI CIRCUIT DESIGN-II	EE-413	7/Longitudinal	0,0,3

Low level and high level design and implementation of digital circuits targeted to FPGAs: Design entry using schematic editor, functional simulation, design entry using VHDL editor, VHDL Synthesis, Functional simulation, Compilation of design, design verification and study of reports. CMOS inverter layout (Step by step process), Layout design of digital circuits using layout tools, Lab. Project.

Title	Code	Semester/Duration	Credits
DIGITAL COMMUNICATIONS	EE-414	7/Longitudinal	3,2,0

Basic elements of communications systems; Review of probability theory; Baseband pulse transmission (matched filters, intersymbol interference); Eye pattern, Nyquist criteria; Equalization; Digital Passband transmission:
Coherent PSK,FSK,QPSK,MSK; Noncoherent orthogonal modulation; Power spectra and bandwidth efficiency of binary and quaternary modulation schemes; Information theory: Mutual information and channel capacity; Source coding; Error control coding (channel

coding).

Title	Code	Semester/Duration	Credits
OPOELECTRONICS	EE-416	7/Longitudinal	2,0,0

The optical fiber: Types, effects of dispersion, attenuation, nonlinearities. Coupling between optical sources and waveguides. Optical detectors and noise. Optical sources: Optical radiation and amplification, lasers. Optical devices: Sensors and modulators

Title	Code	Semester/Duration	Credits
ELECTIVE- ECONOMIC, FINANCE AND MARKETING	EE-421	-	3,0,0

The aims of Economics, finance and marketing for engineers are to develop basic understanding of economics, finance and marketing for the engineering discipline. The syllabus includes macroeconomics, microeconomics, value chain, financial management, cost and profit, accounting concepts and financial statements, cash flow, rate of return; risk management, investment portfolio, technical analysis; marketing management, marketing mix, marketing media, marketing plan, and business ethics..

Title	Code	Semester/Duration	Credits
AUTOMATIC CONTROL	EE-422	8/Longitudinal	3,1,0

Review of mathematical background (complex variables, Laplace, Diff. Equations); System representation (block diagram, transfer functions, signal flow graph) Modeling of electric and mechanical systems; State variable analysis; Stability; Time domain analysis; Root locus; Frequency domain analysis; Introduction to PID control.

Title	Code	Semester/Duration	Credits
AUTOMATIC CONTROL LABORATORY	EE-423	8/Longitudinal	0,0,2

Experiments to support control theory using physical processes (e.g. water level, temperature control, light intensity control, etc); Control system simulation using Matlab; Modeling of physical (experimental) equipment; Static performance; Transient analysis; Measuring devices; Two-position control; Proportional control; PID control.

Title	Code	Semester/Duration	Credits
ANTENNA THEORY AND DESIGN	EE-424	8/Longitudinal	3,0,3

Fundamental antenna system parameters: gain, directivity, efficiency, input impedance. Theory of transmitting and receiving antennas: reciprocity, equivalence, and induction

theorems, Huygen's principle. Elementary antennas: dipoles, loops, traveling-wave antennas. Antenna arrays: analysis and synthesis of linear arrays, mutual impedance, phased arrays. Aperture antennas: Fourier transform, Babinet's principle. Antenna noise temperature. Special topics: log-periodic antennas, microstrip antennas, corrugated waveguides and horns, reflector and lens antennas.

Title	Code	Semester/Duration	Credits
ELECTROMECHANICAL ENERY CONVERSATION	EE-425	8/Longitudinal	3,1,2

Transformers (construction, operation of single-phase transformers, equivalent circuit, voltage regulation and efficiency, auto-transformers, three-phase transformers), AC machinery fundamentals, three-phase induction machines (construction, operation, equivalent circuit, performance calculations, starting of induction motors, speed control), small AC motors (single-phase induction motors, reluctance and hysteresis motors, universal motors, servo motors, stepper motors.

Title	Code	Semester/Duration	Credits
COMPUTER SCIENCE FOR EE STUDENTS	EE-426	8/Longitudinal	2,1,0

IT services, information representation and data structures; Operating Systems, examples (Unix, Windows); Networks and Security: protocols, the Internet and Intranets, security services and protocols, firewalls and encryption; Programming Languages: low-level and assemblers, high-level, compilers and interpreters; Software Engineering: S/W life cycle, modularity, tools and techniques, documentation, configuration management, S/W ownership and liability; Algorithms: importance & representation, sorting & searching, numerical integration, critical path method, random number generators, simulation, public key cryptography.

Title	Code	Semester/Duration	Credits
RADIO FREQUENCY ELECTRONICS	EE-511	9/Longitudinal	2,1,0

Radio frequency tuned amplifiers. Power amplifiers. Tuned LC oscillators. Crystal oscillators. Automatic gain control.

Mixers. High-frequency models of BJT. S-parameters. Introduction to Microwave devices: HBT and MESFET.

Title	Code	Semester/Duration	Credits
COMMUNICATIONS SYSTEMS	EE-513	9/Longitudinal	3,1,0

Overview of communications systems, copper wire transmission systems, Digital subscriber loops (xDSL) , Introduction to radio transmission systems; microwave and millimeter ware radio relay systems; wireless local loops (WLL) ; satellite systems for fixed and mobile communications (GEO, MEO, LEO) ; VSATs systems, Noise, Noise
– Figure and SNR analysis in communication systems ; link budget analysis , Principles of cellular mobile systems.

Title	*Code*	*Semester/Duration*	*Credits*
INTRODUCTION TO ARTIFICIAL INTEGLLIGENCE	EE-514	9/Longitudinal	2,0,0

Problem solving methods. Search spaces. Knowledge representation. Reasoning. Natural language understanding. Pattern recognition. Computer vision. Expert systems. AI languages.

Title	*Code*	*Semester/Duration*	*Credits*
ELECTROMECHANICAL ENERGY CONVERSION-II	EE-515	9/Longitudinal	2,0,2

Synchronous machines (construction, internal voltage, equivalent circuit, phasor diagram, performance of turboalternator, generator operating alone, parallel operation of AC generators, synchronous motor, steady-state operation, starting), DC machines (construction, classification, performance, motor characteristics, starting of DC motors, speed control of DC motors).

Title	*Code*	*Semester/Duration*	*Credits*
GRADUATION PROJECT-1	EE-516	9/Longitudinal	0,3,0

This is the first phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the Electrical & Electronic engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of Semister 2.

Title	*Code*	*Semester/Duration*	*Credits*
ADVANCED ELECTRONIC CIR	EE-519	9/Longitudinal	3,1,0

Timers: 555 circuit and its applications. Analog switches. Analog multipliers. Operational transconductance amplifier (OTA). Current conveyor. Switched capacitor circuits. Phase-locked-loop (PLL) with applications. Data conversion: digital-to-analog and analog-to-digital converters. Digital PLL.

Title	Code	Semester/Duration	Credits
COMMUNICATION NETWORKS	EE-521	10/Longitudinal	3,1,0

Introduction to networking; Multiplexing and switching principles; Teletraffic analysis of circuit switching; Teletraffic analysis of packet switching; The ISO-OSI protocols; WANs and LANs; Internet and Intranet principles and TCP/ IP protocols; network flow; High speed networks.

Title	Code	Semester/Duration	Credits
COMPUTER NETWORK SECURITY	EE-522	10/Longitudinal	3,2,0

This course focuses on state-of-the-art computer network security technologies, which are crucial to the success of any electronic commerce systems. The course covers fundamental techniques of cryptography, security threats and their possible countermeasures, secure protocols, and other network security schemes (authentication, key management, firewalls, intrusion detection, etc.).

Title	Code	Semester/Duration	Credits
PROGRAMMABLE LOGIC CONTROLLERS	EE-523	10/Longitudinal	2,0,3

Basic concepts of microcontrollers. The structure of programmable logic controllers: I/O, relays, counters and timers. Ladder diagram concepts. PLC's intermediate and advanced functions. PLC's data sets and data manipulations. PLC's industrial applications in the process control. Concepts of PLC's communications.

Title	Code	Semester/Duration	Credits
GRADUATION PROJECT-II	EE-526	10/Longitudinal	0,3,0

This is the implementation phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the Electrical & Electronic engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of the Semister.

VISION AND MISSION

The VISION of the Excellence in architectural education Department and applied contemporary design innovations according to international standards of quality in the field of architecture and building technology. The MISSION is to improve the efficiency and effectiveness of architectural education to provide students with knowledge and experience to enable them to design architectural projects with emphasis on local and regional contemporary architectural styles.

ENTRANCE REQUIREMENTS

1 - A student interested in joining the Faculty of Engineering, has to:

2 - Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry and computer or engineering sciences. International students who have not studied Arabic and religious studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.

3 - Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.

4 - Apply electronically though the website of the Admission and Accreditation Office, Ministry of Higher Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Engineering- .

5 - Pay the published fees: 15,000 SDG or US $ 3,500 [international students]

CAREER ADVICE

Architecture arises from same origins as other universal manifestations of material culture. However, the artifacts designated as architecture possess a scale, permanence and a pervasive influence unique among human endeavors. These qualities give the discipline a cultural prominence that few other professions enjoy. Therefore, the study of architecture is concerned with complex, interdisciplinary issues. Some matters are primarily individual and practical: the basic human need for shelter and the desire to contrive efficient, adequate forms for the patterns of daily life. Architecture also serves a higher purpose, expressing the living values of a culture. It gives form, order and proportion to human activities. The practice of architecture today requires coordinated contributions from a variety of fields. Consequently, the study of architecture at National University, Sudan investigates principles and applications of technology, art, humanities, engineering, physical and social sciences, business and management. The Bachelor of Science degree in Architecture & Building Technology degree is intended for students seeking a professional career in architecture. The curriculum is designed to meet the requirements to prepare the graduate for professional practice. Sudanese and international graduates enjoy the availability of jobs in public and private companies or pursue their own business. They may continue postgraduate education in masters and PhDs to teach in colleges of Architecture.

FACULTY OBJECTIVES

The objectives of the National University Faculty of Engineering -Architecture and Building Technology (ABT) Department are to :

1- Ensure the ability to conceptualize and coordinate designs, addressing social, cultural, environmental and technological aspects of architecture

2- Ensure that graduates possess the ability to recognize the dialectic relationship between people and the built environment in the region

3- Apply and integrate computer technology in design processes and products

4- Utilize cutting edge building technology in design

5- Apply visual and verbal communication skills at various stages of architectural design and project delivery processes

6- Analyze critically building designs and conduct post occupancy evaluation studies

7- Employ architectural research methods including data collection and analysis to assess and propose improvements in existing built environments

8- Work collaboratively with teams of architects and various interdisciplinary design teams involved in the building industry

9- Recognize diversity of needs, values, behavioural norms, social patterns as they relate to the creation of the built environment

Curriculum Objectives [Characteristics of the Architecture and Building Technoloy graduate

A graduate of the National University- ABT curriculum should be able to:

1 - Conceptualize and coordinate designs that address some of the most salient social, cultural, environmental, theoretical, economic, and technological aspects of architecture.

2 - Recognize the dialectic relationship between people and the built environment in a region and apply principles of sustainable design.

3 - Apply and integrate computer technology in design processes, documentation, and products of complete architectural drawings.

4 - Utilize cutting-edge building technology in design and incorporate life safety systems.

5 - Build abstract relationships, and to use visual and verbal communication skills throughout the project delivery process.

6 - Analyze critically building designs, and to comprehend constructability.

7 - Use a variety of analytical research methods when evaluating the building environment.

8 - Work collaboratively with various design teams involved in the building industry, and to collaborate and negotiate with clients and consultants.

9 - Recognize diversity of needs, values, behavioural norms, and social patterns as they relate to the creation of the building environment.

10- Get involved with designing new buildings, extensions or alterations to existing buildings, or advising on the restoration and conservation of old properties.

11- Work on individual buildings or on large redevelopment schemes, and can be responsible for the design of the surrounding landscape and spaces..

12- Work closely with clients and users to make sure that projected designs match their needs and are functional, safe and economical.

13- Control projects from start to finish and work with a number of construction professionals, including surveyors and engineers, producing drawings and specifications that the construction team works to.

TIMETABLE

The student has to earn 186 credit hours to obtain a B.Sc. degree in Architecture & Building Science. The study programme for BSc students in the Architecture & Building Science Department is distributed over 10 semesters as follows:

Semester 1 [19 CHs- 18 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Computer Studies I	ARC111	2	-	3	**3**
2	Design Studio I	ARS111	4	8	-	**6**
3	History and Theory of Architecture I	ARH111	2	-	-	**2**
4	Mathematics I	ARM111	2	2	-	**3**
5	English Language I	ARENL111	3	-	-	**3**
6	Sudanese Culture	SCL111	2	-	-	**2**
			15	**10**	**3**	19

Semester 2 [21 CHs- 20 weeks]

Semester 2 [19 CHs- 18weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Computer Studies II	ARC121	2	-	3	**3**
2	Design Studio II	ARS121	4	8	-	**6**
3	History and Theory of Architecture II	ARH121	2	-	-	**2**
4	Mathematics II	ARM121	2	2	-	**3**
5	English Language II	ARENL121	3	-	-	**3**
6	Fundamentals of Engineering and Ethics	GEN122	2	-	-	**2**
			15	**10**	**3**	19

Semester 3 [18 CHs- 20 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Architectural History	ACH211	2			2
2	Building Materials I	BS212	2	-	-	2
3	Architectural Graphics II	ACH213	2	-	3	3
4	Engineering Mechanics - Statics	MATH214	2	2	-	3
5	Architectural Computer Aided Drafting II	ACH215	2	-	3	3
6	Chemistry for Engineering	CHEM216	3	-	3	4
7	Engineers in Society	MISS217	1	-	-	1
			14	2	9	18

Semester 4 [18 CHs- 20 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Architectural Design Studio I	ACH221	1	-	6	3

2	Building Materials II	BS222	2	-	3	3
3	Structural Principles	ACH223	3	2	-	4
4	Differential Equations	MATH224	2	2	-	3
5	Architectural Detailing	ACH225	2	-	3	3
6	History of Modern Architecture	ACH226	2	-	-	2
			12	4	12	18

Semester 5 [19 CHs- 20 weeks]

	Title	Code	Units			CH
			Th	Tut	Lab	
1	Architectural Design Studio II	ACH311	1	-	6	3
2	Sustainability: Building and Living Green	ACH312	2	-	3	3
3	Working Drawings-Residential	ACH313	1	0	6	3
4	Codes, Specifications and Estimating	BS314	2	-	-	2
5	Sustainable Materials	BS315	3	-	-	3
6	Statistics	MATH316	2	-	-	2
7	Modeling & Animation	ACH317	2	-	3	3
			14	11	2	19

Semester 6 [18 CHs- 20 weeks]

Semester 6 [18 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
ctural Design Studio III	ACH321	2	-	6	4
mental Systems	BS322	1	0	6	3
able Sites	BS323	3	0	0	3
er Applications for Construction	BS324	2	0	3	3
nd Structure	ACH325	2	-	-	2

ction Materials and Application I	BS326	3	-	-	3
		13	0	15	18

Semester 7 [19 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
ign Studio IV	ACH411	2	-	9	5
tion	BS412	3	-	-	3
ectrical and Mechanical	BS413	3	-	-	3
ural Systems in	ACH414	3	-	-	3
erials and Applications II	BS415	3	-	-	3
mating	BS416	2	-	-	2
		16	0	9	19

Semester 8 [19 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
sign Studio V	ACH421	2	-	9	5
gy Technologies	BS422	2	-	0	2
ty Development	BS423	1	-	-	1
Design	BS424	2			2
	ACH425	2			2
es	BS426	3	-	3	4
nd Exterior Finishing	ACH427	2	-	3	3
		12	0	12	19

Semester 9 [18 CHs- 20 weeks]

Title	Code	Units			CH

		Th	Tut	Lab	
chitectural Design Studio VI	ACH511	2	-	9	5
onstruction Safety and Equipment	BS512	2	-	-	2
te Preparation and Layout	BS513	2	-	-	2
esidential Remodeling	ACH514	1	-	3	2
oncrete Construction	BS515	3		3	4
aduation Project –I	ACH516		9		3
	0	10	9	15	18

Semester 10 [19 CHs- 20 weeks]

Title	Code	Units			CH
		Th	Tut	Lab	
ctural Design Studio VII	ACH521	2	-	9	5
g Economics for Architecture	ACH522	2	-	-	2
Finish and Trim	ACH523	2	-	3	3
e from ACH Dept	ACH 524	3			3
e from BS Dept	BS 525	3			3
ation Project –II	ACH 526		9		3
		12	9	12	19

COURSE OUTLINES

This course is designed to provide students with a working knowledge of the elementary

physics principles mentioned above, as well as their applications, and to enhance their conceptual understanding of physical laws.

Title	Code	Semester/Duration	Credits
CALCULUS FOR ENGINEERING	MATH-114	1/Longitudinal	3,2,0

Functions of engineering importance; review of polynomial, exponential, and logarithmic functions; trigonometric functions and identities. Inverse functions (logarithmic and trigonometric). Limits and continuity. Derivatives, rules of differentiation; derivatives of elementary functions. Applications of the derivative, max-min problems, Mean Value Theorem. Antiderivatives, the Riemann definite integral, Fundamental Theorems. Methods of integration, approximation, applications, improper integrals.

Methods of integration: by parts, trigonometric substitutions, partial fractions; engineering applications, approximation of integrals, improper integrals. Linear and separable first order differential equations, applications. Parametric curves and polar coordinates, arc length and area. Infinite sequences and series, convergence tests, power series and applications. Taylor polynomials and series, Taylor's Remainder Theorem, applications.

Title	Code	Semester/Duration	Credits
INTRODUCTION TO ARCHITECTURE	ARCH-115	1/Longitudinal	1,0,0

Overview of the architectural field. Emphasis on tours of architectural Buildings and construction sites. Topics include career paths, educational opportunities and the architect's responsibilities.

Title	Code	Semester/Duration	Credits
FREEHAND ARCHITECTURE DRAWING-I	ARCH-117	1/Longitudinal	0,0,6

Students will acquire skills in freehand drawing through exercises, with special emphasis on understanding the principles of and practising perspective drawing techniques. The course is designed to familiarise students with freehand drawing of 3D objects, the use of basic drawing techniques and methods in order to develop visual abilities and visual expression skills. Additional tasks include exercises designed to develop 3D imaging skills, combination skills and creativity.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL COMPUTER AIDED DRAFTING-I	ARCH-118	1/Longitudinal	1,0,3

Introduction and practical application of Computer-Aided Drafting (CAD) techniques and standards used to create two-dimensional architectural drawings. Focus on hardware

and software components, operating systems, file management, CAD commands, system variables, drawing setup, creation of lines and shapes, and the editing, saving, and printing of drawings. Advanced topics include external references, layouts, paper space, attributes, dimensioning, text, and the creation of a symbols library.

Title	Code	Semester/Duration	Credits
LINEAR ALGEBRA FOR ENGINEERING	MATH-126	-	2,0,0

ts. Introduction
onalization.

Applications. Complexnumbers.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL HISTORY	ARCH0-211	3/Longitudinal	2,0,3

Overview of architectural history from prehistory to modern times. 1. Prehistoric architecture. 2. Ancient architecture, (Egyptian, Mesopotamia, Persian, Greek, Roman, and Bezentanian).

3. Medieval architecture (Romanesque and Gothic, Renaissance). 4. The 19th century and the first half of the twenty century in Europe and North America. Identification of architecture styles by their cultural expression of belief systems within the religion and politics of the era. Emphasis on the built environment; attention also given to expression through art.

Title	Code	Semester/Duration	Credits
FREEHAND ARCHITECTURE DRAWING-II	ARCHI-127	2/Longitudinal	0,0,6

Students will acquire skills in freehand drawing through exercises, with special emphasis on understanding the principles of and practising perspective drawing techniques. The course is designed to familiarise students with freehand drawing of 3D objects, the use of basic drawing techniques and methods in order to develop visual abilities and visual expression skills. Additional tasks include exercises designed to develop 3D imaging skills, combination skills and creativity.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL GRAPHICS-I	ARCH-128	2/Longitudinal	1,0,6

Introduction to the various means by which architects have traditionally communicated and presented their buildings. Topics include basic drawing and sketching, model making, and the use of computer software to generate and manipulate presentations. Emphasis on composition, line quality, precision, and clarity of presentation. Introduction

to the architectural jury.

Title	Code	Semester/Duration	Credits
BUILDING MATERIALS-I	BS-212		2,0,3

Study of the history, development, and application of residential building materials. Designed to provide a solid background in the construction and detailing of residential building materials as well as an appreciation for the appropriate use of materials and the field of architecture.

Title	Code	Semester/Duration	Credits
PHYSICS FOR ENGINEERING	PHYS-213	3/Longitudinal	3,0,3

Calculus-based introduction to the basic concepts of fluids and sound, heat, kinetic theory, and entropy, including such topics as: fluid mechanics and motion, sound Waves: speed, harmonic waves, intensity, temperature and heat: thermal expansion, heat capacity, conduction and radiation, kinetic theory of gases: First Law of Thermodynamics, internal energy of a gas, heat capacities, adiabatic expansion, entropy and the Second Law: concept of equilibrium and entropy, heat engines, efficiency of heat engines and refrigerators, introduction to statistical mechanics.

Title	Code	Semester/Duration	Credits
ENGINEERING MECHANICS-STATICS	MATH-214	3/Longitudinal	2,2,0

Vector operations. Equilibrium of a particle. Free body diagram. Moment of forces about a point and about an axis. Equivalent systems. Equilibrium of a rigid body in two and three dimensions. Trusses (method of Joints and sections) . Frames and machines. Dry friction

Title	Code	Semester/Duration	Credits
ARCHITECTURAL COMPUTER AIDED DRAFTING-II	ARCH-215	3/Longitudinal	2,0,3

Practical application of computer-aided drafting software to produce three-dimensional designs, documentation drawings, and computer-generated renderings.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL GRAPHICS-II	ARCH-215	3/Longitudinal	2,0,3

Practical application of Building Information Modeling (BIM) and 3D design software to produce three-dimensional designs, documentation drawings, and computer-generated renderings.

Title	Code	Semester/Duration	Credits
ELCTIVE- ENGINEERS IN SOCIETY	MISS-217	-	1,0,0

Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behaviour, code of engineering ethics, responsibilities of professional engineer, professional behaviour. Basics of law for engineers: introduction to Sudanese legal system, law of contract, industrial law, intellectual property law .etc.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL DESIGN STUDIO-I	ARCH-221	4/Longitudinal	1,0,6

Design studio with an emphasis on basic design principles. Includes overview of principles and criteria used in the programming, analysis, and design phases for small- and medium-sized projects.

Title	Code	Semester/Duration	Credits
BUILDING MATERIALS-II	BS-222		4+4

Study of the history, development, and application of commercial building materials. Designed to develop a solid background in the construction and detailing of commercial building materials as well as an appreciation for the appropriate use of materials.

Title	Code	Semester/Duration	Credits
STRUCTURAL PRINCIPLES	ARCH-223	4/Longitudinal	3,2,0

forces and the basic design of wood, the design of masonry, and co general conce

Title	Code	Semester/Duration	Credits
DIFFERENTIAL EQUATION	MATH-224	4/Longitudinal	2,2,0

Ordinary differential equation: formation of differential equations; solution of first order differential equations by various methods; solution of differential equation of first order but higher degrees; solution of general linear equations of second and higher orders with constant co-efficient; solution of Euler's homogeneous linear differential equations. Partial differential equation: introduction, linear and non-linear first order differential equations; standard forms; linear equations of higher order; equations of the second order with variable coefficients.

Title	Code	Semester/Duration	Credits

STATISTICS	MATH-316	5/Longitudinal	2,2,0

Statistics: measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions, e.g. normal and exponential distribution.

Title	*Code*	*Semester/Duration*	*Credits*
ARCHITECTURAL DETAILING	ARCH-225	4/Longitudinal	2,0,3

Overview of the practice of architectural detailing. Topics include functional principles, standards, constructability, and aesthetics.

Title	*Code*	*Semester/Duration*	*Credits*
ARCH-226	ARCH-226	6/Longitudinal	3,0,0

Worldwide overview of modern architectural history from the mid-nineteenth century to the present. Topics include new processes and cultural phenomena that have occurred as a result of modernization. Emphasis on the influence of new technologies, building materials, globalization, environmentalism, and the economics of energy in shaping societies, environments, and architectural design.

Title	*Code*	*Semester/Duration*	*Credits*
ARCHITECTURAL DESIGN STUDIO-II	ARCH-311	5/Longitudinal	1,0,6

Design studio focusing on the principles used in the design of building sites. Topics include climate, topography, contour modification, pedestrian and vehicular movement patterns, legal constraints, economic factors, site drawings, site models, and site analysis. Includes development of site designs for small and medium-sized projects.

Title	*Code*	*Semester/Duration*	*Credits*
SUSTAINABILITY BUILDING AND LIVING GREEN	ARCH-312	5/Longitudinal	2,0,3

Overview of the concept of sustainability (holistic living and building design that integrates solar concepts, energy efficiency, and material ecology) and its economic, political, and environmental consequences. Lecture and hands-on application focus on sustainable building practices, including design, specification, construction, lifecycle issues, and LEED certification. Exploration of the historical basis for the ideology of sustainability, its applications in today's society, and the implications of choosing to live a green lifestyle.

Title	*Code*	*Semester/Duration*	*Credits*

WORKING DRAWINGS - RESIDENTIAL	ARCH-313	5/Longitudinal	1,0,6

Practical application of computer-aided drafting techniques and construction theory to prepare residential type working drawings. Course work includes developing a complete set of drawings based on wood construction, using CAD drafting standards, efficient database organization, drawing clarity, thoroughness, and attention to dimensioning, cross-referencing, and plotting.

Title	*Code*	*Semester/Duration*	*Credits*
CODES, SPECIFICATIONS AND ESTIMATING	BS-314		0

Introduction to the Codes , standards, specifications, and estimating. Topics covered include the interpretation and utilization of building codes, standards, and regulations; techniques used to estimate building costs; the use of specifications to define and limit materials; fabrication and installation in the construction industry; and specification development as an essential part of the contract document.

Title	*Code*	*Semester/Duration*	*Credits*
SUSTANABLE MATERIALS	3BS-315		3,0,0

Examination of the need, development and application of sustainable building materials, methods, and systems used in both residential and commercial construction. Emphasis on those materials that reduce environmental and energy impact.

Title	*Code*	*Semester/Duration*	*Credits*
MODELING AND ANIMATION	ARCH-317	5/Longitudinal	2,0,3

Introduction to object-driven 3D animated rendering software. Practice includes using various methods to create 2D and 3D objects, manipulating objects, setting lighting conditions, creating materials and animating a scene.

Title	*Code*	*Semester/Duration*	*Credits*
ARCHITECTURAL DESIGN STUDIO - III	ARCH-321	6/Longitudinal	2,0,3

Design studio with an emphasis on the methodology involved in the design of non-residential buildings and the challenges they present to the environment. Investigation of the problems in creating exterior space. Emphasis on the practice of architectural detailing.

Title	*Code*	*Semester/Duration*	*Credits*
WORKING DRAWINGS- COMMERCIAL	ARCH-322	6/Longitudinal	1,0,6

Theory and laboratory practice in the development of non-residential type working drawings. Emphasis on object-oriented CAD techniques, drafting standards, and theory of commercial construction in the preparation of drawings for a building incorporating masonry construction.

Title	Code	Semester/Duration	Credits
ENVIRONMENTAL SYSTEMS	BS-322	6/Longitudinal	2,0,3

Theory and design of plumbing, heating, air conditioning, lighting, and electrical service systems for residential and commercial buildings. Includes CAD drawing techniques and standards in the development of related drawings.

Title	Code	Semester/Duration	Credits
SUSTAINABLE SITES	BS-323	6/Longitudinal	3,0,0

Theory and application of the development of sustainable sites at scales ranging from the individual plot to a neighborhood, a community, or an urban plan. Emphasis on the integration between a particular site and the greater community. Course work includes development of site plans that incorporate sustainable concepts

Title	Code	Semester/Duration	Credits
COMPUTER APPLICATIONS FOR CONSTRUCTION	BS-324	6/Longitudinal	2,0,6

Introduction to the use of the microcomputer for construction applications. Basic design, construction estimating, project management, word processing, spreadsheets, database, and construction related business software are used and evaluated. Computer equipment, keyboard, and other related software for the construction field are included.

Title	Code	Semester/Duration	Credits
FORM AND STRUCTURE	ARCH-325	6/Longitudinal	3,2,0

The contents of the course include the relationship between structure, natural environment and architecture by presenting historical background about this relationship. It introduces different structural systems that include the skeleton structures, frames, trusses, cables, tents and pneumatic and smart structures. With emphasis of the role of these structures in composing the form of the building and the ability to integrate different systems such as HVAC, Sanitary and lighting.

Title	Code	Semester/Duration	Credits
ARCHITECHTURAL DESIGN STUDIO-IV	ARCH-411	7/Longitudinal	2,0,3

Design studio with an emphasis on passive design strategies employed to reduce the energy consumption and increase human comfort. Focus on small and medium-sized

residential and commercial buildings. Topics include the importance of site and climate conditions, the use of the sun to provide heat and light to indoor environments, the use of natural ventilation, and the impact of passive strategies on building form.

Title	Code	Semester/Duration	Credits
ELECTIVE: HISTORIC PRESERVATION	BS-412		3,0,0

Introduction to the concepts of preservation and adaptive re-use and their importance to sustainable design. Topics include historic materials, construction techniques, building systems, the economics of preservation, forensics, remediation practices, and a review of related legislation, government programmed and resources.

Title	Code	Semester/Duration	Credits
INTRODUCTION TO ELECTRICAL AND MECHANICAL SYSTEM	BS-413	7/Longitudinal	3,0,O

Introduction to the electrical, plumbing and HVAC systems used in residential and light commercial buildings. Emphasis on the advantages and disadvantages of various systems, and how their design and installation integrates into the management of the building process. Particular attention is given to the contractor's viewpoint and the soliciting and managing of mechanical and electrical sub-contractors.

Title	Code	Semester/Duration	Credits
ADVANCED STRUCTURAL SYSTEMS IN ARCHITECTURE	ARCH-414	7/Longitudinal	3,0,0

1. Introduction defining, structures and its impact on building form. 2. Criteria for selecting the appropriate structural systems to fit architectural design. 3. Simplified analysis of the structural behaviour of the following large span systems: cables, tents, arches, shells, folded plates, 2D and 3D grid structures and tall buildings. 4. Materials and methods of construction.

Title	Code	Semester/Duration	Credits
CONSTRUCTION MATERIALS AND APPLICATIONS-II	BS-414	`7/Longitudinal	3,0,0

Study of commercial and residential finish materials and light commercial structural methods, providing the technical knowledge base necessary to manage and direct the building process for light commercial buildings and projects in which sustainability is an integral part. Building types studied include pre-engineered and tilt-up concrete and composite types consisting of masonry, steel, and wood modular systems.

Title	Code	Semester/Duration	Credits

CONSTRUCTION MATERIALS AND APPLICATIONS-II	BS-414	7/Longitudinal	3,0,0

Study of commercial and residential finish materials and light commercial structural methods, providing the technical knowledge base necessary to manage and direct the building process for light commercial buildings and projects in which sustainability is an integral part. Building types studied include pre-engineered and tilt-up concrete and composite types consisting of masonry, steel, and wood modular systems.

Title	*Code*	*Semester/Duration*	*Credits*
ARCHITECTURAL DESIGN STUDIO-V	ARCH-421	8/Longitudinal	2,0,9

Design studio with an emphasis on the principles and benefits of Building Performance Modeling. Focus on the design and representation of complex, medium-sized commercial projects in varied environmental settings. Topics include the use of Building Information Modeling (BIM) as a design tool to evaluate overall building performance and energy usage. Course work includes design documentation, development of cost estimates, simulation of the construction sequence, and development of BIM throughout the building's life cycle with an emphasis on the design phase.

Title	*Code*	*Semester/Duration*	*Credits*
ELECTIVE: RENEWABLE ENERGY TECHNOLOGY	BS-422	8/Longitudinal	2,0,0

Overview of renewable energy using sunlight, wind, tides, geothermal, biomass and biofuels. Topics include the relative efficiencies and installation of various energy systems, and a review of public policies, incentives, and grants.

Title	*Code*	*Semester/Duration*	*Credits*
LAND AND PROPERTY DEVELOPMENT	BS-423	8/Longitudinal	1,0,0

Examination of the interrelated parts of the land development process. Topics include market study, financing, site selection and analysis, and environmental regulations affecting land development. Emphasis on managing the process while making sure each essential part is completed to move the project from design to a finished development..

Title	*Code*	*Semester/Duration*	*Credits*
WHOLE BUILDINGS DESIGN	BS-424	8/Longitudinal	2,0,0

and design in order to achieve high
building performa

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luring all stage

Title	Code	Semester/Duration	Credits
ELECTIVE-INTERIOR FINISH AND TRIM	BS-424	-8/Longitudinal	2,0,3

Principles and methods of interior finishing. Includes the installation of interior trim, doors, stair building, and cabinetry. Also included is modern finishing materials: drywall, plaster, tile, paneling, wallpaper, flooring, carpet, and ceiling treatments..

Title	Code	Semester/Duration	Credits
INTERIOR FINISH	ARCH-425	8/Longitudinal	2,0,0

Introduction to the skills and knowledge base needed to effectively finish the interior of a structure. Floor finish techniques include traditional hardwood, floating laminate systems, and ceramic tile installation. Wall finish techniques focus on gypsum board products, wood paneling, and ceramic tile. The application of unitized ceiling finish systems such as suspended ceilings and acoustic tile is covered as well as textured finishes applied over gypsum board products. Applicable IRC code standards for interior finish are studied and applied.

Title	Code	Semester/Duration	Credits
MASONRY PRINCIPLES	BS-426	8/Longitudinal	3,0,3

Introduction to masonry construction materials and methods, with an emphasis on the terms, definitions, and methods of construction practices related to concrete block, brick construction, and thin masonry veneer. Topics also include the different types of mortar mixes and their strengths and uses, reinforcement of masonry walls, masonry cleaning, weather protection for masonry, and estimating supplies and materials.

Title	Code	Semester/Duration	Credits
ROOF FRAMING AND EXTERNIOR FINISHING	ARCH-427	8/Longitudinal	2,0,2

Study of various types of roofs and parts of a roof system, including layout terms, rafter sizes, rafter layout, and the use of a framing square. Emphasis on roof framing principles and application, including gable, hip, and intersection roof designs. Course work includes construction of various roof systems and skill development in the selection and installation of siding and roofing materials, soffit, and fascia.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL DESIGN STUDIO-VI	ARCH-511	9/Longitudinal	2,0,3

Design studio with emphasis on integrated design approach during all stages of planning

and design in order to achieve high building performance. Emphasis on the establishment of benchmarks and the use of computer applications to evaluate the interaction of design decisions. Course work includes case studies of existing buildings and urban context as well as teamwork to design and evaluate medium to large commercial building projects, including structural and environmental systems.

Title	Code	Semester/Duration	Credits
CONSTRUCTION SAFETY AND EQUIPMENT	BS-512	9/Longitudinal	2,0,0

Survey of auxiliary equipment and systems used to perform construction work, focusing on their safe and effective operation. Course work includes erecting various types of scaffold, operating moving equipment, and power generating equipment. Other topics include personal safety issues, issues specific to individual pieces of construction equipment, and OSHA requirements/guidelines specific to the construction industry.

Title	Code	Semester/Duration	Credits
SITE PREPARATION AND LAYOUT	BS-513	-9/Longitudinal	2,0,0

Introduction to site management, site preparation, and layout of structures as it relates to current code and safety standards. Topics covered include the use of the construction instruments for laying out structures, triangle calculations, differential leveling, and erection of batter boards and markers.

Title	Code	Semester/Duration	Credits
CONSTRUCTION MATERIAL AND APPLICATIONS-1	BS-513	-9/Longitudinal	3,0,3

Study of residential building techniques and materials. Topics include specific erection and fabrication techniques, construction materials, as well as their uses and sustainability. Both traditional and prefabricated/ pre-manufactured methods and materials are covered. Course serves as technical knowledge base for those who will manage the residential building process.

Title	Code	Semester/Duration	Credits
RESIDENTIAL REMODELING	ARCH-514	9/Longitudinal	1,0,3

Introduction to planning and implementing a residential remodeling project. Emphasis on the development and presentation of a professional contract through the preparation of drawings, specifications, schedule, and estimates. Additional remodeling-related topics include customer relations, green remodeling and sustainability issues, insurance, bonding, liens, sales and marketing, IRC requirements, hazardous substances, historical district issues, and code inspection sequences. The planned project will be constructed in the lab.

Title	Code	Semester/Duration	Credits
GRADUATION PROJECT-I	ARCH-516	9/Longitudinal	0,0,6

This is the first phase of the capstone project that is a continual project over two semesters, and involves one or more students working as one team tackling different aspects of the archtitecture engineering works, which may involve research and development work OR design. Students will be assigned a research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of Semister 2.

Title	Code	Semester/Duration	Credits
ARCHITECTURAL DESIGN STUDIO-VII	ARCH-521	10/Longitudinal	2,0,3

Design studio focusing on the knowledge and skills developed in all previous programme courses. Focus on the design of large and tall commercial buildings through all phases of development, including presentation and juried review. Emphasis placed on passive design, sustainable materials, energy efficiency, renewable energy technologies, sustainable rating systems, and the use of building information modeling to analyze, document and present comprehensive building solutions

Title	Code	Semester/Duration	Credits
BUILDING ECONOMICS FOR ARCHITECTURE	ARCH-522	10/Longitudinal	2,0,0

1. Introduction to building economics and life cycle of building projects. 2. Economic feasibility: preliminary and detailed. 3. Methods of rationalization of building cost: during design contracting and implementation stages.
4. Methods of estimation of building cost. 5. Practical applications and case studies.

Title	Code	Semester/Duration	Credits
GRADUATION PROJECT-II	ARCH-526	10/Longitudinal	0,0,6

This is the implementation phase of the capstone project that is a continual project over two semesters, and involves one or more students working as one team tackling different aspects of the archtitecture engineering works, which may involve research and development work OR design. Students will be assigned a research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of Semister 2.

Emphasis on benchmarks and using computer applications to evaluate the interaction of design decisions. Course work includes case studies of existing buildings and teamwork to design and evaluate building projects.

Title	*Code*	*Semester/Duration*	*Credits*
ELECTIVE-CONCRETE CONSTRUCTION	BS-515	9/Longitudinal	3,0,3

Principles of concrete design, including water/cement ratios, proportions of ingredients, reinforced concrete, concrete footers and walls, finishing with hand and power trowel equipment, and proper methods of curing and testing concrete..

Title	*Code*	*Semester/Duration*	*Credits*
ELECTIVE- CHEMISTRY FOR ENGINEERING	ENG-000	-	3,0,3

Chemical bonding, properties of matter. Chemical thermodynamics with applications to phase equilibria, aqueous equilibria and electrochemistry. Processes at surfaces.

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