

COURSE DESCRIPTIONS FOR THE SCHOOL OF ENGINEERING

EA 300 Introduction to (Bio) Energy Engineering

Definition of energy, forms of energy, properties of energy, characteristics of energy, laws of conservation of energy, energy generation, transformation, transmission, storage and conversion. Sources of energy including an introduction to power generation, electrical energy, hydropower, thermal power, cell energy, bio energy, geothermal, tidal, solar, hydrogen, fossil, combustion analysis, energy usage, energy saving, wind energy, fuels and their energy contents, Environmental impact of energy usage, clean energy and environmental entrepreneurship. Biofuels including biomass, biodiesel, algae, hydroponics, vertical farming, food Vs energy crisis, bioengineering, Energy and metabolism, how cells harvest energy. Energetics: including activation energy, catalysis, and enzymes, oxidation and reduction, electron carriers, higher-energy phosphate compounds and adenosine triphosphate (ATP). Energy release in biological systems, fermentation, respiration, oxidation and phosphorylation, the energy cycles.

UNIVERSITY REQUIREMENTS

GS 201: Use of English I (2 units)

Listening and writing abilities through examples from articles and illustrations from a variety of literatures, and from writing assignments. Use of English for technical purposes such as preparation of reports, project proposals, professional oral presentation, etc. Preparation of applications, resumes and executive summaries. Technical vocabulary and referencing systems. Business communication techniques, speech drilling.

GS 221: Use of English II (2 units)

In-depth technical reports with overviews of articles of technical topics for the general public. Practical report writing elements of speech writing and management communication statements. Use of library resources: library classification systems, authors and subject indices, searching for specific information. Sections of a library (general circulation, reserved book room, serials, audiovisuals etc). Use of computer and internet in research.

GS 202: Use of French I (2 Units)

Students will learn to develop skills in listening, speaking, reading and writing, with a special emphasis on reading and speaking. Development of listening and writing abilities through examples brought from articles taken from a variety of literatures and from writing assignments.

GS 222: Use of French II (2 Units)

This is a sequel to Use of French I. While all four language skills are still emphasized, students will be introduced to cases and examples which have complex structure and higher level of difficulty. Advanced training in French conversation is recommended.

GS 203: Introductory Computer Science (3 Units)

Brief history of the development of the computer. Characteristics of computers. Input and output devices. Basic

anatomy of the computer. Computer Software and hardware, RAM and ROM. Storage devices. Computer Languages – Machine codes, assembly codes, high level languages (translation, compiling, interpreting). Other Languages (BASIC, COBOL, FORTRAN, PASCAL,C etc). Problem solving with a computer – flow charts, algorithms, iterations etc. Principles of programming. Introduction to computer networks. Computer applications.

GS 301: Cameroon History and Cultures (2 Units)

Review of Cameroon history from Pre-colonial times till the early 1990's. Settlement, government, economy languages social values and ways of life. Factors that determine the sustenance of peace and stability. Artistic and technological creativity. Geography and natural resources. Trends in social and cultural development.

GS 501; Private Enterprise Development. 3 units

This course provides broad overview of the world of business, preparing students for various business-related subjects. Emphasis is placed on business organisations in general, including the objectives and overall responsibilities of business enterprise. Students will learn the language of the business world and the legal forms of business. Preparing a business plan will be covered in detail. Additional topics in small business, entrepreneurship and OHADA rules for setting up a company will be looked at. At the end of the semester, each student will write and defend a business plan before a panel.

SCHOOL OF ENGINEERING REQUIREMENTS

MTH 201: Engineering Mathematics I (3units)

Ordinary differentials equations of the first order. Linear ordinary differential equations of higher order - matrix notation, homogeneous solutions, method of variation of parameters. General ordinary differential equations - series solution. Partial differential equations - methods of separating variables, initial value and boundary value problems. Integral calculus - integrals of functions, techniques of integration, numerical integration, improper integrals etc. Multiple integrals.

MTH 221: Engineering Mathematics II (3 units)

Mathematical induction. Functions, limits, continuity, etc. Fourier analysis - Fourier series, integrals and transforms. Laplace transformation and application to the solution of ordinary differential equations and electrical circuits. Vector Algebra and calculus in three dimensions. Gauss law, Stoke's theorem, Green's theorem etc. and their applications. Special functions – Bessel's functions, gamma functions, Chesbychev's hammid polynomial etc.

EA 201: Engineering Drawing I (3 units)

Lines and lettering. Applied geometry. Free hand drawing. Drawing instruments. Dimensioning, scales, enlargement and reduction. Revolutions. Tangency problems - line tangent to an arc, circles that touch each other, etc. Engineering drawing symbols. Enough practice sessions and assignments recommended.

EA 221: Engineering Drawing II (3 units)

Basic Descriptive geometry dealing with points, lines and their relationship in space. 1st and 3rd angle orthographic

projections. Isometric drawing. Sectional views and conventions. Assembly drawing. Introduction to computer graphics. Enough practice sessions and assignments recommended.

ENG 201: Basic Engineering Laboratory I (2 Units)

Laboratory practice and experimental studies on topics covered in departmental courses in the first semester.

ENG 221: Basic Engineering Laboratory II (2 Units)

Laboratory practice and experimental studies on topics covered in departmental courses in the second semester.

EA 301: Engineering Management Science. (3 Units)

Application of quantitative methods in solving management problems:- linear programming modeling, graphical methods for sensitivity analysis, assignment problems, network models, integer linear programming, goal programming, analytic hierarchy process, decision analysis, project management, simulation, and forecasting models.

EA 302: Numerical Methods (3 Units)

Error analysis, Eigen problems, nonlinear equations, approximation and interpolation techniques, numerical differentiations and integration. Numerical solution of polynomials and ordinary differential equations.

EA 321: Topics in Engineering Mathematics. (3 Units)

Vector spaces, linear transformations, matrices (determinants and inversion), system of linear equation, Gauss elimination, Cramer's rule, Cayley-Hamilton's theorem, eigen value problems, eigen value and eigen vectors, diagonalisation, complex matrices Introduction to complex analysis – complex numbers, analytic functions, Complex integration, Conformal mapping. Calculus of variation. Introduction to tensor analysis.

EA 322: Computing Tools in Engineering (3 Units)

Theories and techniques of numerical analysis and usage of computer software for engineering: - Finite differential interpolation, numerical differentiation and integration. Introduction to MATLAB, SPICE, Electronic workbench, AutoCAD and other computer tools in engineering.

EA 303: Computer Programming for Engineers (3 Units)

Introduction to programming in FORTRAN. Concept of object oriented programming; class, inheritance, polymorphism and encapsulation. Fundamentals of C++ programming language. Programming practice assignments recommended.

EA 323: Probability and Random Processes. (3 Units)

Random experiments, events, probability, discrete and continuous random variables, probability density function, cumulative distribution function, functions of random variables, expectations. Law of large numbers, central limit theorem. Introduction to random processes, random noise, Gaussian random process, autocorrelation and power spectral density.

EA 401: Information Technology Law. (3 Units)

Computers and intellectual property; copyright law, patent law, law of confidence, law relating to designs, trademarks and passing off - applications to computer software. Computer contracts, nature of contracts, software acquisition, hardware acquisition, breach of contract. Computer crime, the scale and nature of computer crime, prosecution of criminal offences, computer fraud, hacking, computer viruses, piracy, computer evidence and criminal proceedings. Data protection and security measures.

EA 402: Engineering Statistics (3 Units)

Measures of central tendency; mean, median, mode, variance, standard deviation. Fundamentals of probability, discrete and continuous probability, moment generating functions, discrete and continuous variables, sampling distributions, hypothesis testing of the means, variance, and proportions. Regression analysis.

EA 403: Engineering Design Seminar (3 units)

The objective of the course is to let the student prepare for his/her final year project. Students must conduct a literature review, discuss with course coordinator and present a seminar at the end of the seminar on the agreed topic.

EA 404: Mini Project(2 units)

Each student will be given a mini project topic by the course coordinator of his/her department. The course coordinator will monitor the student's progress and the student will submit the project together with a written report for grading.

ENG 420: Industrial Training (10 Units)

Students are provided with on-the-job training at elected modern industrial or service facilities. The purposes of the course are to allow the students opportunities to observe how industrial engineers function, to learn how to collaborate with co-workers, and to develop self-responsibility.

The training period must not be less than 480 hours. Students must submit a report together with their log books at the end of the training period. The grading will be given based on the student's performance, quality of report and industrial based supervisor's comments.

EA 501; Project Management and Occupational Safety. 3 Units

Concepts for project management and techniques for planning, utilizing and controlling of resources to accomplish specific goals. Topics include estimation of project duration, time-cost considerations, workforce allocation, cash flow forecasting, financial and performance control and documentation. Introduction to scheduling software - Microsoft Project or Primavera. P3.

Principles and practice regarding safety in buildings, accidental prevention and safety control. Fire control, fall prevention, excavations etc., safety provisions for fire and other hazards in buildings, safety standards and codes, governmental regulations and inspection procedures.

ENG 500: Senior Project I 3 Units

Practical projects for individual students under the supervision of staff members of the department. Students are required to submit and present the project proposal to their project Committee appointed by the department.

ENG 520: Senior Project II. 3 Units

The continuation of ENG 500 to the completion stage of the project. Students are required to design and construct and submit complete project reports and present project results to their project committee.

DEPARTMENTAL REQUIREMENTS**EE 201: Basic Electrical Engineering I** (3 units)

Current and voltage. Circuit elements. Coulomb's law and its applications. Kirchoff's laws and Resistive circuits. Circuit analysis techniques such as nodal analysis, mesh analysis, superposition and Thevenin's and Norton's order circuits and their responses. Three phase circuits and delta-wye transformation. Mutual inductance and ideal transformers. Passive filters and their responses - corner frequency.

EE221: Basic Electrical Engineering II (3 units)

Semiconductors, PN junction, diodes and zener diodes, halfwave, fullwave and bridge rectifiers, voltage regulators and power supplies. Bipolar junction transistors (BJTs). DC and AC analysis of common emitter amplifiers, (op-amp)-inverting and non-inverting amplifiers, summing and difference amplifiers, integrators and active low-pass, band-pass and high-pass filters. Logic gates and combinational logic. Boolean algebra and De Morgan's theorems.

ME 201: Engineering Statics and Dynamics I (3 units)

Dynamics of particles - velocity, acceleration, force, momentum. Laws of motion, work, power, energy, impulse, impact of elastic bodies, projectiles, circular motion, gravitation, simple harmonic motion. Dynamics of rigid body - moment of inertia and radius of gyration of various rigid bodies, rigid body motion. Problems involving coefficient of friction

ME 221: Engineering Statics and Dynamics II (3 units)

Introduction to structural analysis - Reactions, shear and moments in statically determinate structures. Influence line. Analysis of stresses in trusses (method of sections and method of joints). Structures subjected to moving loads. Deflection of beams and frames by methods of virtual work and strain energy. Williot-Mohr diagrams. Analysis of statically indeterminate structures by method of consistent deformation.

CE 201: Strength of Materials (3 units)

Concepts of internal force and stress, deformation and strain. Analysis of stress and strain and Mohr's circles. Strain and stress in thin-walled pressure vessels. Thermal stresses - energy method. Torsion of circular shaft, thin walled tubes, and close-coiled helical spring. Shear force, bending moment and bending stress in beams. Deflection of beams.

CE 221: Material Science (3 units)

Properties (physical/chemical) and structure of materials including metals, crystal lattices, alloys, ceramics, polymers, wood, composites and solid-state materials. Study of microstructures in relationship with mechanical properties of materials and phase equilibrium diagrams. Effects of production processes on microstructure of materials, degradation and failure analysis.

PC 201: Introductory thermodynamics (3 Units)

Definitions and basic concepts. SI Units. Properties of pure substances and ideal gases. Heat and work. First and second laws of thermodynamics and their applications. Use of steam tables. Entropy. Power and refrigerator cycles and equipment including gas turbine, internal combustion engines and steam power plants. Basic heat transfer.

PC 221: Fluid Mechanics (3 Units)

Fundamentals of fluid statics and dynamics - formulation of momentum and energy equations. Formulation of the equations of fluid flow such as Stokes, Euler, Bernoulli, etc. Conservation of mass, viscous flow in pipes, open channel flow, fluid flow measurement. Dimensional analysis and similarity.

EE 301: Analogue Electronic Circuits. 3 Units

Introduction to differential amplifiers and mirrors. Operational amplifiers - 741 Op-amp circuits, feedback amplifiers, frequency response, Bode plots, stability, phase compensation. Comparators. Oscillator circuits. Waveform generators and wave shaping. Active filter and switched capacitor filters. Power electronic circuits - Regulated power supplies, regulators and power amplifiers.

EE 302: Physical Electronics (3 Units)

Thermionic emission - valves and triodes. Quantum mechanical principles. Atomic structure. Energy band theory. Energy bands and charge carriers in semiconductors and metals. Equilibrium and transport properties of semiconductors. PN junction and diode equation. BJTs and FETs. Physical principles of other semiconductor devices of current interest.

EE 303: Electrical Machines (3 Units)

Transformers: Physical characteristics, equivalent circuits, regulation. Three phase transformers. Synchronous and induction machines: principles, characteristics, operation and applications. Three-phase and single-phase induction motors. Control of AC machines. Machine equivalent circuit; practical operation. Methods of starting single-phase induction motors.

EE 304: Digital Systems (3 Units)

Number systems and codes. Logic signals and gates. Electronic circuits of logic gates. Logic gates families and characteristics. Arithmetic circuits. Combinational logic circuits and minimization. Sequential logic circuits. Flip-flops and shift registers. Programmable logic devices. Seven segment and liquid crystal displays. Introduction to A/D and D/A conversions. Introduction to digital integrated circuits.

EE 305: Analogue Electronics Lab. (2 Units)

Laboratory practice and experimental studies on topics covered in EE 301.

EE 321: Electromagnetics (3 Units)

Static electric fields. Conductors and dielectrics, capacitors, convection and conduction currents. Gauss law at it

application (treatment of rectangular, cylindrical and spherical coordination systems). Static magnetic circuits. Time-varying electric and magnetic fields. Maxwell's equations, Poynting's vector, Electromagnetic waves and transmission lines. Propagation modes. Introduction to waveguides and antennas.

EE 322: Power Systems (3 Units)

Basic concepts used in power system analysis such as phasors, complex power, three-phase circuits, and per unit quantities. Voltage, current and power calculations in single phase and three-phase systems. Transmission lines and their impedances. Current and voltage relations in transmission lines. Voltage drop and regulation. Electric power distribution. Power flow analysis, Power system equipment. Introduction to power system protection, monitoring and control. Short circuit analysis (symmetrical and unsymmetrical). Introduction to power line carrier communications (PLC).

EE 325: Electromechanical Energy Conversion 3 Units

Energy conversion. Electromechanical energy conversion and its fundamentals. Basic principles of rotating electrical machines. DC machines: DC generators and motors, construction and windings, characteristics, operation principles and solid state control. Special types of DC Motors such as moving coil motors, brushless motors and stepping motors. Construction and characteristics of transformers. Energy conversion in AC machines. Principles, characteristics, operation and application of synchronous and induction machines. Single-phase and three-phase induction motors. Control of AC machines. Machine equivalent circuit; operation, protection and application of machines.

EE 323: Electrical System Design (3 Units)

Basic design concepts, power distribution schemes. Codes and standards for electrical installations, electrical drawing, load estimation, wiring design, grounding, short-circuit current calculation, coordination of protective devices, power factor improvement, and emergency power systems. Lighting design. Infrastructural system design. Electrical system design in commercial, industrial and residential buildings. Protective design, Specifications and cost estimation. Case studies of electrical system design.

EE 324: Digital Systems Laboratory. (2 Units)

Laboratory practice and experimental studies on topics covered in EE 304.

CCE 301: Principles of Communications (3 Units)

Fourier analysis and transforms. Signal analysis and processing in communication systems. Principles of amplitude, frequency, angular and pulse modulations and demodulation. Digital modulation techniques. Noise in Communication systems and its effects. Data transmission. Error detection and correction schemes. Channel capacity and Shannon's theorem.

CCE 321: Communication Networks and Transmission Lines. (3 Units)

End-to-end requirements. Network theorems. Analysis and design of equivalent one-port and two-port circuits, series and parallel resonance. Wave filters. Impedance transformation and matching. Network approach to theory of transmission lines. Telephone lines. Switching systems, ISDN, Modem and LAN

CE 301: Structural Analysis (3 Units)

Analysis of indeterminate structures; elastic load methods; strain energy method, slope-deflection and moment distribution methods. Influence line for continuous beams and frames. Introduction to plastic analysis. Approximate analysis of building frames. Introduction to finite element methods.

CE 302: Soil Mechanics (3 Units)

Classification of soils, soils and soil formation. Soil constituents and their properties; physical properties of soils, basic engineering properties of soils. Effective stresses and pore pressure, permeability of soils, stress and strain in a continuous body, consolidation. Shear strength and failure of soils. Stability analysis. Plastic equilibrium, upper and lower bound solutions, retaining wall.

CE 303: Engineering Geology (3 Units)

The earth and the universe, geological processes and plate tectonics, minerals and rocks; weathering and erosion. Earthquakes, volcanicity and the earth's interior. Deformation and mountain building-problems of dip and strike, joints, folds and faults. Mass wasting and landslides. Landforms - action of rivers, groundwater, glacier, wind and ocean. Topographic and geological maps. Geology of reservoirs and dams.

CE 304: Foundation Engineering. (3 Units)

Subsurface exploration, Soil/ground improvement, compaction, vibroflotation, precompression, sand drains, mechanical and chemical stabilization, stability of slopes; infinite slopes, mass process line and method of slices. Ultimate bearing capacity and teraghi's bearing capacity theory. Shallow foundation, mat foundation, pile foundation, types of piles, pile capacity, pile driving formula, and group piles. Elastic settlements of both shallow and deep foundations. Sheet piles - cantilever sheet piles and anchored sheet piles.

CE 305: Civil Engineering Laboratory I (2 Units)

Experiments and tests to cover; soil exploration, index properties of soil's permeability, compaction, stress strain behaviour of soils, shear strength and one dimensional consolidation. Sieve analysis.

CE 321: Concrete Designs (3 Units)

Material properties of concrete and reinforcing bars. Fundamental behaviour of thrust, flexure, shear, torsion, bond and interaction among these forces. Design of reinforced concrete structural components. Beams, columns, slabs, stairs, floating, and retaining walls by working stress and strain, design concepts. Analysis of T-beams, continuous beams, deep beams, long columns, combined footings, mat footings, pile caps and composite beams.

CE 322: Transportation Engineering (3 Units)

Characteristics of transportation supply and demand. Measuring and estimating demand, social and environmental impacts. Planning of transportation systems. Characteristics of transportation modes. Highway planning and administration. Traffic analysis. Geometric designs and operations. Highway materials, flexible and rigid pavement design, Highway construction and maintenance. Transportation technology, economics, public policy, implementation and management.

CE 323: Timber and Steel Design (3 Units)

Seasoning of wood. Design of timber and steel structures. Tension and compression of members beams, beam columns, built-up members, plate girders and connection

CE 324: Surveying (3 Units)

Introduction to survey work; basic field works and leveling. Principles and applications of theodolite. Angle measurement, distance measurement, errors in surveying, acceptable error, data correction, triangulation. Precise determination of azimuth, precise traverse plane, coordinate system, precise leveling and route survey. Topographic survey. Map plotting. Introduction to photogrammetry and remote sensing.

CE 325: Material Testing laboratory (2 Units)

Experiments and demonstrations to know: background of concrete, concrete ingredients, types and properties of cement, concrete slump. Setting time of concrete.

ME 301: Engineering Thermodynamics (3 Units)

Properties of pure substances, real gases and ideal gases. First and second laws of thermodynamics and their applications. Adiabatic processes, entropy and ideal gas mixtures. First law of steady flow processes and entropy. Heat engines, Reversibility and irreversibility. Power and refrigeration cycles and equipment including gas turbine, internal combustion engines and steam power plant. Thermodynamics of multi-component and multiphase chemical systems. Properties of mixtures, including colligative properties, chemical reaction equilibrium, and phase equilibrium. Non ideal solutions.

ME 302: Solid Mechanics (3 Units)

Generalized concepts of strain and Hook's law. Thick-walled cylinders and shrink fits. Rotating discs. Open coiled helical springs and impact loads. Axis symmetric bending of circular plates. Buckling of columns. Use of Mohr's circles for transformations of stress and strain. Detailed study of shear force, bending moment and bending stress in beams. Deflection of beams.

ME 303: Fluid Dynamics (3 Units)

Motion of fluid particles and stream lines. Momentum equation and applications. Energy equation applications. Fluid flow theorems and applications. Laminar and turbulent internal flows. Flow of fluid around a body, boundary layers. Similarity and dimensional analysis. Theories and designs of centrifugal and axial-flow pumps, fans, water turbines and cavitations. Flows in open channels. Compressible flow.

ME 304: Chassis Systems and Aeronautics (3 Units)**ME 305: Mechanical Engineering Laboratory I (3 units)**

Tests and experiments on physical and mechanical properties of materials, mechanisms, fluid mechanics, thermodynamics and heat transfer, combustion and internal combustion engines.

ME 321: Heat Transfer (3 Units)

Steady-state conduction. Natural convection. Forced convection. Thermal radiation. Unsteady-state conduction. Combined heat transfer problems. Condensation and boiling heat transfer. Heat exchangers.

ME 322: Refrigeration and Air Condition (3 Units)

Refrigeration cycles and properties of refrigerants. Evaporative cooling and cooling towers. Refrigeration load estimation. Design of refrigeration systems. Equipment selection and design. Psychometric properties and processes of air. Criteria for thermal comfort. Cooling load estimation. Design of air-conditioning systems.

ME 323: Machine Design (3 Units)

Theories of failures for static and dynamic loading. Design of mechanical components such as rotating shafts, bearings, welding, screws, springs, and power transmission devices. Introduction to computer as a tool in problem solving for mechanical design.

ME 324: Hydraulic and Pneumatic Control (3 Units)

Introduction to control systems. Open and closed loop control systems. Feedback control systems. Static and dynamic modeling of hydraulic and pneumatic component systems. Energy and power transfer and impedance matching concepts. Dynamic performance and stability of open and closed loop servodrives. Introduction to hydraulic and pneumatic control system design.

ME 325: Workshop Practice (3 Units)

Mechanical workshop practice to include; mechanical tools, carpentry, welding and fabrication (both electric arc and gas welding), casting and the use of lathe machine.

ARCH 301: Introduction to Urban Design and Development (3 Units)

Current practice of urban design in the United States and its context. Examination of new opportunities and constraints in environment assessment; decision making and management in local government; mechanisms for land use controls or incentives; public investment strategy and case studies assessing major development strategies used in today's practice. Residential forms, including the private residence, apartments and tenements, worker's housing and utopian schemes; with European examples for comparison.

ARCH 302: Urban Planning (3 Units)

Principles and perceptions of urban form. Analysis of elements of urban form to establish morphological framework of cities. History, Literature and theories of urban forms. Comparison of generic, as well as unique patterns of urban form; processes by which that form has evolved. Typological principles that transcend culture, time and place.

ARCH 321: Theory and Methods in Architectural Art. (3 Units)

Active systems of climate control in buildings and their relation to energy management. Evaluation and selection

of mechanical equipment systems, their cost implications and effectiveness. Design considerations in integrating various systems. Introduction to sanitation, fire protection, and vertical transportation systems.

ARCH 322: Introduction to Civil Engineering Design I (3 Units)

Study of statics and strength of materials - Theoretical and scientific basis to understanding how various structural systems and structural materials work and withstanding loading. Quantitative and qualitative analysis of simple structural elements such as trusses, beams and columns.

ARCH 323: Architectural Professional Practice I (3 Units)

Phases of management in which architects are involved, from inception of a project to its realization. Office organization , contractor and owner management of projects, construction cost analysis, organization and preparation of construction documents. Review of legal papers and standardized forms. Alternative patterns of construction management relations. Engineering patterns of architectural practice.

PC 301: Engineering Biochemistry. (3 Units)

Survey of basic principles of biochemistry and molecular biology, emphasizing broad understanding of chemical events in living systems in terms of metabolism and structure - functional relationships of biologically important molecules. Chemical kinetics and mass energy balances; reactions mechanisms, batch, plug flow and well steamed reactors. Modeling and design of batch and continuous bioreactors. Gas - liquid mass transfers for aeration and agitation instrumentation and control.

PC 302: Introduction to Petroleum Engineering Systems (3 Units)

Overview of petroleum engineering systems including: uses of petroleum products, exploration, exploitation subject such as drilling, production, reservoir and formation evaluation, transportation and refining, marketing, government regulation and political influence.

PC 321: Cell Biology and Enzymatic Systems (3 Units)

Techniques of cultivation, quantization, isolation and identification of micro organisms with emphasis on bacteria; effects of physical and chemical agents. Concepts of enzyme catalysis; analysis of enzyme reaction rate. Binding and hybridization interactions.

PC 322: Petroleum Reservoir Fluids (3 Units)

Properties of petroleum behaviour of gases, phase behaviour of liquids. Qualitative and quantitative phase behaviour of hydrocarbon systems. Reservoir fluid characteristics. Application of these concepts to the prediction of gas and gas condensate behaviour. Fluid content, permeability, flow of fluids in reservoir rocks, and properties responding to well logs.

PC 323: Reservoir Engineering (3 Units)

Fundamentals of evaluation of oil and gas reservoirs. Reservoir volumetrics; material balance; Darcy's law and equation of continuity, diffusivity equation; stream lines; well models; introduction to well testing; decline curve analysis; natural water influx.

EE 401: Power Electronics (3 Units)

Characteristics of power electronic devices, power diode, SCR, GTO, diacs, Triacs etc. Industrial control devices, DC monitors and control circuits. AC motors and variable-frequency drives. Converters, AC to DC converters, DC to DC converters, cyclo-converters, frequency changers. Introduction to numerical control.

EE 402: Switching Theory. (3 Units)

Models for sequential circuits; state tables and state diagrams, clock and pulse modes, and Mealy and Moore models. Analysis of synchronous sequential circuits (SSS); completely and incompletely specified circuits, state assignment, equivalent states, state reduction, circuit realization and synthesis of SSC. Analysis of asynchronous sequential circuits (ASC); races, cycles, hazards and synthesis of ASC. Introduction to fault diagnosis, sequential circuit and regular expression.

EE 403: Introduction to Control Engineering (3 Units)

Feedback and closed loop control systems. Transfer function, block diagram algebra and signal flow graphs. Mathematical modeling of physical systems; equations of electrical networks, modeling of mechanical systems, elements and equations of mechanical systems and sensors, decoders, DC motors in control systems; steady state error and transient response. Stability of control systems; Routh-Hurwitz criterion. Root locus techniques. Frequency domain analyses of control systems; Nyquist stability criterion. Bode plots; gain and phase margins.

EE 404: Integrated Circuit Technology. 3 (Units)

Theory and practice of diffusion, oxidation, ion, implantation, photolithography and etching. Layer deposition, bipolar, NMOS, CMOS technologies. Introduction to design and fabrication of very large scale integrated systems. CAD tools and computer-aided design. Logic families and their characteristics. Sources of propagation delay. Noise margins. Dynamics loads. Crosstalk. Programmable logic gate arrays (PLA).

EE 405: Electrical and Electronics Workshop (2 Units)

Students are introduced to electrical/electronic workshop practice; electrical safety, soldering and electrical wiring. I-V characteristics of transistors, diodes, etc. Use of data books.

EE 406: Measurement and Instrumentation 3 units

Ammeters, voltmeters and wattmeters. Wheatstone bridge. Electrical measurement of distance, pressure, level, temperature and colour detection. Electrical and mechanical controlling devices such as programmable logic controllers (PLC). The Components of Computer integrated manufacturing (CIM) including the design of information frameworks and network protocols. CAD/CAM interfacing. Heating values of fuels, calorimeter and exhaust gas analysers. Data monitoring and acquisition systems.

CCE 401: Communication Electronics (3 Units)

RF and power amplifiers, oscillators, phase-locked loops, filters, carriers, modulators and demodulators. Active filter design using op amps. Practical op amp limitations, stability and frequency compensation. Time division and frequency division, multiplexing. Bistable, astable and monostable multivibrators

CCE 402: Data Communication Networks. (3 Units)

Network models, OSI layers and protocols, TCP/IP, CISCO, VoIP, WAN, LAN, MAN. Routing algorithms and switching techniques. Networking equipment such as ATM, routers and bridges.

CE 401: Construction Methods and Technologies. (3 Units)

Construction of foundations; pile foundations, mat foundations; erection of formworks and shoring. Concrete work in practice; storage of materials, batching mixing, transporting, placing, consolidating, surface finishing, curing etc. Construction of mass concrete, construction of bridges, construction of tunnels, highways, dams and underground construction.

CE 402: Structural Dynamics (3 Units)

Essential characteristics of dynamics problems, dynamics of simple structures. Single degree-of-freedom system, laws governing motion, free vibration response. Response to periodic forces. Analysis of response to arbitrary dynamics loading by Duhamel integral. Dynamics of Complex structures, multi-degree-of-freedom systems; formulation of matrix equations of motion by energy approach, nodal analysis. Concept of principal coordinates. Introduction to structural responses to wind and earthquake. Introduction to vibration control techniques.

CE 403: Pavement Design (3 Units)

Characteristics of pavement loads, stress analysis in pavements, design practices, construction, rehabilitation and maintenance, optimization of the design of rigid and flexible pavement systems, empirical and mechanistic stochastic structural subsystems, utility theory, serviceability concept, cost studies, traffic delay and environmental deterioration,

CE 404: Bridge and Building Design (3 Units)

Design concepts of various types of buildings, analysis and design of each component of building including foundation, frames, shear wall, slab wall and others with emphasis on reinforced concrete building. Planning of bridge projects. Design, analysis and construction of various types of bridges including reinforced and pre-stressed concrete bridges, steel bridges, composite bridges and cable-supported bridges.

CE 405: Water Supply and Sanitary Engineering (3 Units)

Sources of water supply - drinking water standards, quality requirements, groundwater collecting. Water transmission and distribution. Cold water systems. Waste and vent systems. Water treatment techniques - screening, coagulation and flocculation, sedimentation, filtration, disinfection, softening removal, taste and odour removal.

ME 401: Thermal System Design (3 Units)

Design procedure. Comparison between a workable system and optimum system. Equation fitting for equipment and processes characterization. Modeling of equipment and processes based on physical laws. Simulation of thermal systems. Selected optimization techniques such as La Grange multiplier, Search methods, linear programming, etc.

ME 402: Automotive Engineering. (3units)

Dynamics of vehicles, structures, suspensions, steering, brakes and drive-train. Vehicle performance and handling modes. Basic internal combustion processes; engine components, supercharging, turbo-charging and compounding. Electrical Systems in automobile. Introduction to the design of passenger vehicles.

ME 403: Production Planning and Scheduling (3 Units)

Study of the components and functions of integrated production, planning and control systems. Consideration is given to material, equipment and manpower requirements for optimizing continuous and intermittent manufacturing operations. Topics include demand forecasting, line balancing, operation sequencing and scheduling, etc.

ME 404: Quality Control (3 Units)

Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble; to measure process capability and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans are discussed. Total quality control and quality control Circle.

ME 405: Manufacturing Engineering Laboratory (2 units)

This course provides hands-on exercises on CAD/CAM, machine programming and control (lathe and milling), and robot programming and control.

ARCH 303: Architectural Design I 3 units

Jurisdictional constraints, preparation of drawings, computerization and designer's responsibility. Rules of redundancy. Loads and forces, dead loads, line loads, settlement loads, thermal loads, dynamic loads, torsion loads, wind loads, structural systems, beams, columns, bracing, vectors and flat plates

ARCH 304: Architectural Design II 3 units

Wood beams, shear, bending moment, deflection, bearing area, notched beams, lateral support, depth reduction, curvature reduction, single and double tapered beams, two and three hinged arches. Floor and roof systems – lightweight I-joists, flat trusses, gable trusses, gluelams, timber domes, hypars. Columns-tapered columns, spaced columns, stud walls, pole structures. Connections-nails, screws and bolts, sheet metal fasteners, hinges, spiral dowels. Bracing and oblique loads.

ARCH 406: Architectural Design III 3 units

Steel; beams-shear, bending moment, deflection, lateral support, bearing plates, web stiffeners, built-up beams, flange stiffeners. Trusses – warren trusses, pratt trusses, truss chords, truss gusset plates. Floor and roof systems - composite design, metal decking, open-web joists, staircases and space frames. Columns – built-up sections, economic sections, pedestals and bases, poles, light metal framing and fasteners. Connections – bolts and rivets, welds, combined bolted and welded connections, pinned connections, eyebars, hooks and cables, bracing.

CCE 302: Security and Cryptography 3 units

Principles of number theory and the practice of network security and cryptographic algorithms. Topics include primes, random numbers, modular arithmetic and discrete logarithms, conventional or symmetric encryption, and public key or asymmetric encryption, key management, hash functions, digital signatures, certificates and authentication protocols, electronic mail security, web security and protocols for secure electronic commerce, some applications, such as smart cards, electronic voting and some programming topics e.g provable security.

CCE 322: Artificial Intelligence and Expert Systems 3 Units

Overview of current research and application of artificial intelligence. Introduction to the languages of artificial intelligence such as Prolog or LISP. Search techniques. Knowledge representation, reasoning, interference. Machine learning. Overview of neural networks and expert systems.

CCE 323: Software Engineering 3 Units

Methodology and strategy for developing medium and large scale software. Topics include software management, problem analysis, cost estimation, system design techniques, system testing and performance evaluation and system maintenance. Individual software process, software quality concept and culture. Software quality standards. Software quality processes. Process assurance and product assurance.

ARCH 506: Architectural Design IV 3 units

Concrete; beams – bending moment, shear, diagonal tension, deflection, bond shear, T-beams, steel beams in concrete. Floor and roof systems – slabs, floors, staircases, spandrels and openings in slabs, shell structures. Columns – round and rectangular. Walls – bearing walls, basement walls, retaining walls. Bracing. Connections – dowels, hooks, expansion bolts and anchor bolts, shelf edges. Footings – soil bearing, wall footings, column footing, combined footings, grided footings, foundations under heavy machinery, piles and pile caps. Non-reinforced masonry – pillars and piers, bearing and non-bearing walls, chimneys and arches. Reinforced masonry – pillars and piers, cavity walls, concrete block walls. Earth construction. Other structures – aluminum, plastic, fabric structures, seismic design.

ARCH 201: History of Architecture I

Ancient to medieval architecture – a survey of prehistoric, ancient near eastern Egyptian, greek, roman, early Christian, Byzantine, early medieval Romanesque, and gothic architecture.

ARCH 221: History of Architecture II

Renaissance to modern architecture – a survey of renaissance, baroque, rococo, romantic, Victorian, modern, post-modern, and contemporary architecture in Europe and America.

ARCH 401: Urban Housing (3 Units)

Detailed investigation into American and European residential forms. Investigation into Japanese architecture and cities, especially Japanese symbolic and spiritual dimensions, as they engage in the making of space and place. Both landscape architecture (gardens) and traditional domestic architecture and its construction for every day's

life will be surveyed. Works of ancient architects strongly influenced by traditional Japanese architecture will be studied.

ARCH 402: Introduction to Building Technology I (3 Units)

The micro scale of construction. Emphasizes details of construction. Major interfaces of materials and systems; foundation\wall, wall>window, wall\roof, floor\wall, etc. The effect of materials and processes on appearance and life of building components. Interior and exterior finishes, joints, fire protection and specifications.

ARCH 403: Introduction to Civil Engineering Design II (3 Units)

Examines dimensional analysis, models, prototypes, systems of forces and mass, structural materials and structural theories. Experiments in torsion elements and analogies and three-dimensional structural systems. Detailed studies with mock-ups and stability of elements in structural systems.

ARCH 404: 20th Century Art. 2 Units

Introduces the fundamentals of architectural design from the theory and practice of the 1450s to the built and manifestos of modern times. Situation of the architectural discipline within the context of social, cognitive and technological transformation.

ARCH 405: Lighting Design in Buildings 3 Units

Principles of lighting, lighting designs for buildings which include artificial lighting, point, line, and area light sources, types and properties of luminaries, polar curves, design methods and calculations, glare index, lighting design standard, luminaries, heat recovery system and lighting energy management, hybrid lighting, day lighting of buildings., effects of climate on lighting.

PC 401: Oil Field Development. 3 Units

Properties of petroleum fluids and reservoir rocks. Geophysical environment and exploration methods. Drilling and completion methods, well testing, producing mechanisms and evaluation methods. Well completion selection, casing design, cementing, perforating, hydraulic fracturing, acidising and chemical stimulation. Well bore configuration, well planning, direction control, drilling programme preparation, offshore operations, cost control and AFE. Post-drilling review and economics.

PC 402: Reservoir Engineering. 3 Units

Darcy's Law and its applications. Well inflow equations for stabilized flow conditions. Oil and gas well testing. Material balance equations. Predicting reservoir performance. Natural water inflow and immiscible displacement. Hydrocarbon phase behaviour, saturation pressure, mercury injection method for determining capillary pressures. Gas-oil relative permeability and enhanced oil recovery.

PC 403: Chemical Reaction Kinetics and Reactor Design 3 Units

Introduction to the design of chemical reactors via synthesis of chemical kinetics and mass\energy balances; reaction mechanisms, batch, plug flow and well-stirred reactors. Heat and mass transport in reactors including

diffusion to and within catalyst particles. Gas-liquid mass transfer for aeration and agitation instrumentation and control.

PC 404: Unit Operations 3 Units

An integrated study of fundamentals and quantitative design techniques involving flow of fluids. Application of fluid mechanics including piping, pumping compression, metering, agitation and separation. Applications of heat transfer by conduction, convection and radiation to design of process equipment.

PC 405: Petrochemical Laboratory 2 Units

Laboratory practice or computer simulations to demonstrate properties of drilling and completion fluids, well control, oil and gas well testing, production operations, evaluations of artificial lift systems and gas measurement.

EE 501: Circuit Analysis 3 Units

Network graphs. Node and mesh analysis. Cut-set and loop analysis. State equations. Network responses: natural frequencies, network functions, impulse responses, frequency responses, resonance. Fourier transform and applications to network analysis. Two-port circuits. Introduction to computer aided circuit analysis and design.

EE 502: Analogue Circuit Design 3 Units

Review of 1st and 2nd order analogue filters, i.e. bilinear transfer functions and frequency response, cascade design with 1st order filters, the biquad circuits. Butterworth low-pass and band-pass filters. The Chebyshev's response. Sensitivity. Delay filters. Frequency transformation. Ladder design with simulated elements. Switched-capacitor filters. Active filter stability and frequency compensation. Non-linear circuit applications. Analogue multipliers and dividers. Phase-locked loops. (PLL). Power amplifier design

EE 503: Microprocessor Systems 3 Units

Microprocessor architecture, instruction sets, assembly language programming. Two's complement and floating point arithmetic. Microprocessor interfacing and applications; partial and full address decoding, pipelining, parallel processing, cache memory, SRAM, DRAM, EPROM. SDK-85, Seven Segment Displays, CRO, System bus, interrupts, DMA and I/O interfacing techniques. 16 and 32 bit processors.

EE 504: Control System Engineering 3 Units

Linear and proportional-integral differential (PID) control systems, open and closed loop control systems, system response, etc. Routh stability, Nyquist stability, Stability in the sense of Lyapunov (ISL) etc. Modern Control systems; state space representation of control systems, state transition matrix, observability and controllability, phase variables and Jordan Canonical forms. Pole assignment techniques.

EE 505: Electrical Engineering Laboratories 2 Units.

Laboratory practice and experimental studies on selected topics not covered in other practical courses.

EE 521: Topics in Electrical Engineering. 3 Units

New Topics or Areas not offered in other electrical/electronics engineering courses. Topics may vary from session to session.

EE 522: Industrial Electronics. 3 Units

Thyristors. Industrial control devices. DC motors and control circuits. AC motor and variable frequency drives. Analog and digital transducers. Industrial process control. Microprocessors and communication system. Theory and analysis of electric motion control in industrial, robotic and traction systems. Operational amplifiers and linear ICs - analogue and digital transducers. Programmable logic controllers.

EE 523: Systems Reliability and Maintainability. 3 Units

Determination of Systems reliability from knowledge of characteristics and reliability of individual system components. Reliability concepts, failure rates, systems analysis, optimisation, maintenance, MTBF, downtimes, etc. Techniques for the formulation and evaluation of reliability models. Preventive and emergency maintenance, scheduling of maintenance activities, etc.

EE 524: High Voltage Engineering 3 Units

Generation and uses of high-voltage, high-voltage measurement techniques, electric field and insulation techniques, breakdown of gas, liquid and solid dielectrics, test of high-voltages, lightning protection. Construction and performance of high voltage equipment.

EE 507: Power System Analysis 3 Units

Transmission and distribution network calculation, load flow, load flow control, symmetrical short circuit analysis, unsymmetrical short circuit analysis, transient stability, economic operation, insulation coordination. Grounding.

EE 506: Power Distribution Management. 3 Units

Power supply requirements. Customer Classification. Over current protection devices and its coordination. Power quality requirements and its control. Reliability of distribution system. Grounding and safety of distribution systems. Electric Power industry. Regulation and deregulation. Power grid and power distribution in the deregulated industry, retail energy service. Ancillary services

EE 525: Power Systems Control 3 Units

Basic Concepts, definitions, units and classifications. Dynamic modeling of various power system components. Transient stability analysis. Methods of stability improvement. Power system oscillations. Economic dispatch of thermal and hydro units. Unit commitment. Automatic generation control. Power pool and evaluation of power interchange. Power system security, state estimation. Computer modeling of power system components; synchronous generator, transmission system. Computer analysis and techniques for load flow, short circuit study, stability etc.

CCE 501: Antennas and Microwave Principles 3 Units

Basic definitions and theorems, formation of the radiation problems, isotropic point source, power and field

patterns, directivity and gain, radiation impedance, wave polarisation radiation from current elements. Analysis and design of linear array and aperture antennas. Maxwell's equations and boundary conditions, transmission line theory, S-parameters, smith charts, impedance matching, waveguides, microwave resonators and filters. Microwave network analysis, power dividers and directorial couplers, microwave measurement and applications. Introduction to radar systems.

CCE 401: Data Structures and Algorithms

Concepts of data structure; data structure and programming; basic data structures, stacks, queues, linked lists; trees, graphs etc; recursion; hash tables; sorting and searching algorithms. High-level programming languages. Types, control flows, iteration, functions and procedures. Program structure. Storage allocation. String processing. Recursive programs. Algorithm design. Program debugging.

CCE 402: Tele-services and Services Architecture

Modern telecommunications, service providers and experience market expansion and changes in service provisioning technologies. This course aims at presenting students an architectural foundation, based on the convergence of computer, telecommunication and digital content technologies. Topics include intelligent networks, Common Object Request Broker Architecture (COBRA), and common service architectures available in several telecommunications standards. Also to be treated are; electronic commerce and the internet, characteristics of digital products and processes, product information, market efficiency, copyright protection, and electronic payment systems.

CCE 523: Computer Architectures 3 Units

Computer evolution. Conventional computer and architectures. CPU and ALU structures and design. Instruction sets. Hardwired and microprogrammed control. Pipelining. Array and vector processors. Multiprocessor systems memory organizations. Cache memory

CCE 524: Operating Systems

CCE 502: Digital Signal Processing 3 Units

Discrete time signals and systems. Z-transform and its application to discrete-time system analysis. Linear time-invariant systems and their properties. Sampling of continuous time signals and convolution. Digital filter designs. Effects of finite word length. The discrete Fourier transform. Fast Fourier transform algorithms. Relations between Fourier transform, Discrete-frequency Fourier transform (or Fourier series), Discrete time Fourier transform and discrete Fourier transform (Discrete both time and frequency).

CCE 503: Data Communication Networks

Data Communication concepts. Theory and techniques in data communications: transmission, encoding, decoding, error detection, error correction, link control, networks and standards. Data communication hardware and software. Network models, OSI layers, and protocols, TCP/IP, VoIP, WAN, LAN, Routing algorithms and switching techniques. Networking equipment, such as ATM, router, and bridge.

CCE 504: Communications Laboratory 2 units

Experiments on topics covered in CCE 501, CCE 502 and CCE 503.

CCE 521: Modern Communication Media 3 units

Cylindrical dielectric waveguides and propagating conditions, optical cable types, link budget and evaluation, optical transmission parameters, laser principle, Laser modulation techniques by feeding baseband IF or RF, Optical detections, regenerative repeater, application of optical fibre production and process. Fibre optic communication systems. Coding, multiplexing and demultiplexing. Principles of cellular radio, mobile radio propagation and channels, digital mobile communications systems: GSM and multi-carrier systems. Introduction to space communication and frequency used. Communication satellites and their principal subsystems. Multiple access. Earth stations. Satellites Networks and techniques in satellite Communications.

CCE 522: Digital Speech and Image Processing 3 Units

Speech quality and intelligibility. Speech coding standards, linear predictive coding techniques, frequency domain codes. Speech enhancement and noise reduction. Speech recognition. Digital image fundamentals. Image transformations. Image enhancement. Image restoration. Image compression. Image segmentation. Representation schemes and descriptors.

CCE 523: Topics in Computer and Communications Engineering 3 Units

New Topics or Areas of study not offered in other computer and communication engineering courses. Topics may vary from semester to semester.

CE 501: Construction Engineering Management 3 Units

Project delivery system; Project organization; site layout; project planning; critical path method; resource Management; Progress measurement; Construction safety; Quality systems; Contracts and tendering; Construction laws and regulations; Construction methods and equipment; Cost estimation.

CE521: Construction Estimating and Tendering 3 Units

Principles of construction cost estimating; Quality take off; methods of detailed cost estimating; analysis of labour and equipment costs; construction tendering process; bidding and contracting systems for construction projects; civil Engineering project appraisal and feasibility study.

CE 502: Photogrammetry and Remote Sensing 3 Units

Basic concepts of photogrammetry; Cameras and photography; Mathematical and geometric principles relevant to photography; Rectification and Orientation; Orthophotography; Mosaic; Applications of photogrammetry. Basic concepts of remote sensing; sensor and platform; Digital imagery; Image enhancement; Rectification and classification.

CE 503: Advanced Structural Concrete Design 3 Units

Analysis and design of T-beams, deep beams, long columns, combined footings, mat footings, pile caps and composite beams; shear friction behaviour and design; strut and tie models; design of one, two and multi-storey houses; introduction to prestressed concrete design.

CE 504: Engineering Hydrology

3 Units

Hydraulic cycle; Atmosphere water; subsurface water; groundwater; Surface water. Unit hydrograph; flood routing; hydrologic statistics; Frequency analysis. Engineering economy in water resources planning; Reservoirs; Design of gravity dams, arch dams, buttress dams and earth dams; Design of drainage systems.

CE 505: Material Testing and Technologies

3 Units

Tests on: properties of cement, properties of aggregates, properties of fresh cement paste, properties of fresh mortar, properties of fresh concrete, strength test of hardened concrete, tensile test of reinforcing steel, test on flexural reinforced concrete member; Soil compaction tests etc. Storage of materials, batching mixing, transportation, placing, consolidating, surface finish, curing etc.

CE 522: Port and Airport Engineering.

3 Units

Planning and design of seaports and harbour, planning of container terminal and cargo handling systems, effects of waves on coastal structures, design of seawalls, ship channels and pipelines, airport master planning, air traffic control, design of airport facilities.

CE 523: Tunnelling and Underground Excavations

3 Units

Tunnelling and excavations in hard rock, rock mechanics, shape, size and orientation of an opening, elastic deformation and the Kirsch solution, rock mass classification, support design and ground reaction curve, drill and blast method, NATM tunnelling, deformation and surface settlement, load on liners, face stability, methods of soft ground tunnelling including EPB and slurry shield methods.

CE 524: Site Investigation

3 Units

Surface/subsurface exploration; Concept of land use mapping and terrain evaluation; site location and site investigation for roadways and tunnels; Groundwater exploration; Dam and reservoir site investigation; waste disposal site location and geotechnical aspect of landfill sites.

CE 525: Topics in Civil Engineering

3 Units

New topics or areas of study not offered in other civil engineering courses. Topics may vary from semester to semester.

ME 501 Mechanical System Design 3 Units

Mechanical engineering system design involving practical problems in industries. Students working in groups will expose the design methodology and process from concept through final design including detail analysis of all mechanical components of the system by which knowledge of engineering disciplines are required. Projects are proposed from various areas of study within mechanical engineering. Students submit a final report and present their projects at the end of the semester.

ME 502: Turbomachinery

3 Units

Review of thermodynamics of compressible flow. Principles, designs and application of centrifugal and axial flow machines, i.e. centrifugal turbine and compressors, axial flow turbine and compressor, impulse and reaction steam turbine and Laval nozzle. Steam and gas turbine plants; theories, applications, performance characteristics

of practical cycles. Erosion problems in steam and gas turbine components.

ME 503: Environmental Control Engineering 3 Units

Review of properties of moist air and refrigerants, refrigeration cycles, refrigeration processes and cryogenics. Solar energy fundamentals and applications. Heat transfer in building structures. Heating and cooling loads. Thermal environmental control systems. Designs heating, ventilation and air conditioning systems (HVAC). Energy conservation in buildings.

ME 504: Logistics and Supply Chain Management 3 Units

This course is specifically designed for students to understand the principles of logistics and supply chain management. Major topics include logistics planning; cooperation and management in the supply chain; transportation; material purchasing and inventory control; packaging; integration between production planning and distribution among partners in the chain and information system. The present and future roles of logistics in the supply chain management are also discussed.

ME 521: Engine Systems 3 units

ME 522: Vibration and Noise Control 3 Units

Vibration; Linear system equation, free and forced responses, systems with two degrees of freedom. Behaviour of sound waves. Sources of environmental noise and vibration and their impacts. Instrumental and practical measurement. General physiological and subjective response to noise and vibration. Regulations, criteria, methods and techniques to reduce and control environmental noise and vibration.

ME 523: Manufacturing Process Design. 3 Units

Introduction of the theory and practice of manufacturing processes. Study covers various types of casting and metal forming processes and technologies. This course emphasizes process selection and design of cost effective manufacturing processes. Linkage between process design and production planning and controls is considered.

ME 505: Mechanical Engineering Laboratory II 2 Units

Students are required to conduct extended tests and experiments on thermo-fluid systems such as fluid machinery systems, gas turbines, refrigeration and air conditioning systems etc. Component modeling and system simulation are expected in the reports submitted for grading.

ME 524: Automation of Production System 3 Units

The course discusses the design, automation and integration of supporting sub-systems in the production environment, which includes flexible manufacturing systems (FMS) cells, automated warehousing, automated material handling systems (conveyor, AGV etc.), and automated inspection. The functions of integrated production

planning, production systems and manufacturing automation are studied. Consideration is given to the link between manual and automated tasks of controlling and monitoring the progress of the product, as it is being processed, assembled, moved and inspected in the factory. The components of computer-integrated manufacturing (CIM) are also discussed.

ME 525: Topics in Mechanical Engineering 3 Units

New topics or areas of study not offered in other mechanical engineering courses. Topics may vary from semester to semester.

ARCH 501: Architectural Professional Practice II 3 Units

Examines the financial framework within which the building industry operates and its impact on design decisions. Further, the course develops in students the analytical skills necessary to evaluate financial and economic viability of project proposals; estimation of project development and operating costs, methods of finance and market forces as components of feasibility studies.

ARCH 502: Site Planning and Urban Designs (3 Units)

Introduction to the discipline and criteria of landscape architecture. The art of site planning; includes analysis in relation to physical factors such as topology, soil structure, climate and behaviour. The ecological basis for site planning and use of vegetation. The design and use of green spaces in modern cities.

ARCH 503: Introduction to Structural Engineering 3 Units

This course begins with an emphasis on the investigation of reinforced structures and continues with the study of various types of foundation systems. Such as footings and retaining and bearing walls. General overview of indeterminate structures and the behaviour of continuous beams, the study of lateral forces and dynamic loading and the impact on the design of seismic and wind resistant structures. Structure configurations, measurements, experiments, construction assemblies and design studio critique.

ARCH 504: Building Protection, Repair and Maintenance. 3 Units

Review of deterioration of building materials, concept of life cycle cost, protection methods against deterioration and corrosion of building materials, types of defects and damages, non-destructive tests, partially destructive tests, load tests, materials for repair and selection methods and techniques of repair, rehabilitation and retrofitting.

ARCH 505: Visual Communications 3 Units

Abstract, Symbolic and representation of systems of Communications. Development of visual and graphic skills and techniques. Multidimensional design and perceptual development. Formulation of abstracted concepts and logical visual models.

ARCH 521: Introduction to Building Technology II 3 Units

Examines systems in large and/or tall structures affecting decisions of architects in relation to lightweight systems, physical constraints of the materials, manufacturing of the material and geometry in the material distribution. Reviews stability considerations of structural systems and individual elements, as well as reserve

strength and redundancy concepts. Comparative study of building types through on-site drawing/recording, measurement, sketching and decomposition activity.

ARCH 522: Landscape and Urban Design. 3 Units

Addresses the overlap between architecture and landscape in which meanings particular to each one are shared and traded. Explores the reciprocity between object and context. Studies this in-between condition through an exploration of dialectical landscape theories; the allegory of paradise; and the work of architects, landscape architects and artists. Architectural and urban design issues using Rome as a repository of examples.

ARCH 523: Computer Applications in Architectural Design. 3 Units

Introductory lesson on computer applications, with an emphasis on architectural graphical output. Theoretical concepts in computing and design; electronic publishing, image manipulation, AutoCAD and Computer modeling tools like COVADIS.

ARCH 524: Topics in Architectural Design. 3 Units

New topic or areas of study not offered in other Architectural courses. Topics may vary from semester to semester.

PC 501: Non-Newtonian Fluid Mechanics 3 Units

Characteristics of stress in fluids. The role of Newtonian fluid mechanics. Extension of Newtonian analysis to Bingham plastics, fluids without yield stress, time dependent non-Newtonian fluids, Laminar and turbulent flow, boundary layers in non-Newtonian fluids. Flow of fluids in porous media, Darcy's Law in a mathematical Sense. The concept of relative permeability applied in a mathematical sense.

PC 502: Surface Production Engineering 3 Units

Artificial lift design; Sucker rod pumping, electric submersible pumping, plunger lift and gas lift. Design of surface production equipment. Oil and gas separation, oil treating, gas dehydration. Single and two-phase flow through pipes, fluid measurement and pipeline System design

PC 503: Petroleum Reservoir Development 3 Units

Petroleum reservoir development and extension. Simulation methods for evaluating a petroleum reservoir, schemes for oil field development. Engineering application of logging and geological, fluid and well-testing data. Reservoir characterization: heterogeneity and anisotropy; recovery mechanisms; Leverett J-Functions; upscaling; flow simulation, history matching and forecasting; uncertainty and risk. Introduction to improved recovery techniques.

PC 504: Kinetic and Enzymatic Systems 3 Units

An Introduction to the general concepts of enzymatic catalysts: analysis of enzyme reaction rate; Binding and hybridization interactions. Modeling and design of batch and continuous bioreactors based on biological growth and mass balances. Gas-liquid mass transfer for aeration and agitation instrumentation and control.

PC 505: Chemical Equilibrium and Kinetics of Environmental Processes 3 Units

Introductory chemical Thermodynamic concepts extended to heterogeneous equilibrium, dilute solutions, surfaces and colloids of significance in environmental engineering, Processes; Chemical reaction kinetics concepts applied to the environment, applications to waste treatment process design, property estimations for elucidating the rate and transport of chemicals in the environment.

PC 506: Environmental Engineering 3 Units

Impacts of environmental pollution; environmental quality standards; sources and characteristics of industrial wastewater and treatment methods; effects and control of oil spillage; sources of air, and land pollutants; Control methods of particulate and gaseous emissions; hazardous wastes (e.g. nuclear waste) and disposal methods.

PC 521: Petrochemical Unit Operations 3 Units

Applications of phase equilibria and mass transfer for stage wise and continuous contact operations such as distillation, absorption, and extraction. Introduction to separation and purification techniques pertinent to petrochemical processes and microbial disinfections.

PC 522: Process Design and Dynamics 3 Units

Application of Chemical engineering fundamentals to the design of a multi-unit process. Emphasis on the use of process simulators. Advanced equipment design. Introduction to dynamic processes and the engineering tasks of process operations and control. Modeling the static and dynamic behaviour of processes. Chemical plant design from initial concept through preliminary estimate; flow diagrams, equipment cost estimation, economic analysis, safety and computed process design.

PC 523 Oil and Gas Engineering Management 3 Units

Oil and natural gas supply and demand, international oil and gas trade and infrastructure, oil and gas policy, regulation, safety and environmental issues, natural gas resource base: Conventional and unconventional gas exploration, drilling and production economics, gas processing, storage and pipeline, oil and gas trading and marketing, gas utilization, LNG, Chemicals.

PC 524 Technologies of Petrochemical Industry 3 Units

Catalytic and thermal processes used in petroleum refining; application of scientific and engineering principles in processes such as catalytic cracking, reforming, coking, alkylation, isomerisation, and hydro processing; emphasis on applied catalysis and its impact on engineering design. Principles involved in the production of hydrogen, alcohols, olefins, aromatics, aldehydes, ketones, acids, rubber, and the polymers with emphasis on catalysts by transition-metal complexes.

PC 525: Electrochemical Engineering 3 Units

Principles of electrochemistry applied to engineering problems; potential distribution theory, kinetics, mass transport, and thermodynamic principles; qualification of controlling factors in micro fabrication, corrosion, battery design, and electrochemical synthesis. Mathematical modeling and control of electrochemical processes. Introduction to thin film deposition.

PC 526: Topics in Petrochemical Engineering 3 Units

New topics or areas of study not offered in other petroleum and chemical engineering courses. Topics may vary from semester to semester.

PET 501: Well Testing Analysis 3 Units

Diffusivity equation; exponential integral solution; principle of superposition; drawdown testing; skin effects; wellbore storage; type curve matching, reservoir limit test; build-up testing, bounded reservoirs, average reservoir pressure; drill stem testing; interface testing; pulse testing; reservoir heterogeneities; anisotropy; stratification; sealing faults.

PET 521: Advanced Reservoir Engineering 3 Units

Optimization of material balance equations; saturation calculation, with and without counter flow; dynamics of water drive reservoirs, accelerated blow down of strong water drive gas reservoirs; conformal mapping of oil and gas fields; the subsidiary equation; tracer methods; streamlines; miscible processes; dispersion models and optimum solvent slug size.

CHE 501: Computational Chemistry 3 Units

Numerical analysis focusing on methods used in mathematical models in chemistry: molecular mechanics and molecular dynamics of small and large molecules, potential energy surfaces, force fields, energy minimization by numerical methods, quantum mechanical properties, *ab initio* and semi-empirical.

CHE 521: Processing of Advanced Materials 3 Units

Treatment of coupled chemical reaction and mass, energy and momentum transport in the manufacturing and processing of semi-conductors and advanced ceramic materials; engineering models for chemical and physical vapour deposition methods and condensed phase processes. Solution and solid-state properties of high polymers; microstructure of polymer chains and effect on macromolecular physical properties of the plastic plastics.

ARCH 303: Architectural Design I 3 Units

Jurisdictional constraints, preparation of drawings, computerization and designer's responsibility. Rules of redundancy. Loads and forces, dead loads, line loads, settlement loads, thermal loads, dynamic loads, torsion loads, wind loads, structural systems, beams, columns, bracing, vectors and flat plates

ARCH 304: Architectural Design II 3 Units

Wood beams, shear, bending moment, deflection, bearing area, notched beams, lateral support, depth reduction, curvature reduction, single and double tapered beams, two and three hinged arches. Floor and roof systems – lightweight I-joists, flat trusses, gable trusses, gluelams, timber domes, hypars. Columns-tapered columns, spaced columns, stud walls, pole structures. Connections-nails, screws and bolts, sheet metal fasteners, hinges, spiral dowels. Bracing and oblique loads.

ARCH 406: Architectural Design III 3 units

Steel; beams-shear, bending moment, deflection, lateral support, bearing plates, web stiffeners, built-up beams, flange stiffeners. Trusses – warren trusses, pratt trusses, truss chords, truss gusset plates. Floor and roof systems – composite design, metal decking, open-web joists, staircases and space frames. Columns – built-up sections, economic sections, pedestals and bases, poles, light metal framing and fasteners. Connections – bolts and rivets, welds, combined bolted and welded connections, pinned connections, eyebars, hooks and cables, bracing.

CCE 302: Security and Cryptography 3 units

Principles of number theory and the practice of network security and cryptographic algorithms. Topics include primes, random numbers, modular arithmetic and discrete logarithms, conventional or symmetric encryption, and

public key or asymmetric encryption, key management, hash functions, digital signatures, certificates and authentication protocols, electronic mail security, web security and protocols for secure electronic commerce, some applications, such as smart cards, electronic voting and some programming topics e.g provable security.

CCE 322: Artificial Intelligence and Expert Systems 3 Units

Overview of current research and application of artificial intelligence. Introduction to the languages of artificial intelligence such as Prolog or LISP. Search techniques. Knowledge representation, reasoning, interference. Machine learning. Overview of neural networks and expert systems.

CCE 323: Software Engineering 3 Units

Methodology and strategy for developing medium and large scale software. Topics include software management, problem analysis, cost estimation, system design techniques, system testing and performance evaluation and system maintenance. Individual software process, software quality concept and culture. Software quality standards. Software quality processes. Process assurance and product assurance.

ARCH 506: Architectural Design IV 3 units

Concrete; beams – bending moment, shear, diagonal tension, deflection, bond shear, T-beams, steel beams in concrete. Floor and roof systems – slabs, floors, staircases, spandrels and openings in slabs, shell structures. Columns – round and rectangular. Walls – bearing walls, basement walls, retaining walls. Bracing. Connections – dowels, hooks, expansion bolts and anchor bolts, shelf edges. Footings – soil bearing, wall footings, column footing, combined footings, grided footings, foundations under heavy machinery, piles and pile caps. Non-reinforced masonry – pillars and piers, bearing and non-bearing walls, chimneys and arches. Reinforced masonry – pillars and piers, cavity walls, concrete block walls. Earth construction. Other structures – aluminum, plastic, fabric structures, seismic design.

ARCH 201: History of Architecture I 3 units

Ancient to medieval architecture – a survey of prehistoric, ancient near eastern Egyptian, greek, roman, early Christian, Byzantine, early medieval Romanesque, and gothic architecture.

ARCH 221: History of Architecture II 3units

Renaissance to modern architecture – a survey of renaissance, baroque, rococo, romantic, Victorian, modern, post-modern, and contemporary architecture in Europe and America.

CCE 401: Data Structures and Algorithms 3 units

Concepts of data structure; data structure and programming; basic data structures, stacks, queues, linked lists; trees, graphs etc; recursion; hash tables; sorting and searching algorithms. High-level programming languages. Types, control flows, iteration, functions and procedures. Program structure. Storage allocation. String processing. Recursive programs. Algorithm design. Program debugging.

CCE 402: Tele-services and Services Architecture 3 units

Modern telecommunications, service providers and experience market expansion and changes in service provisioning technologies. This course aims at presenting students an architectural foundation, based on the convergence of computer, telecommunication and digital content technologies. Topics include intelligent networks, Common Object Request Broker Architecture (COBRA), and common service architectures available in several telecommunications standards. Also to be treated are; electronic commerce and the internet, characteristics of digital products and processes, product information, market efficiency, copyright protection, and electronic payment systems.

CCE 523: Computer Architectures **3 Units**

Computer evolution. Conventional computer and architectures. CPU and ALU structures and design. Instruction sets. Hardwired and microprogrammed control. Pipelining. Array and vector processors. Multiprocessor systems memory organizations. Cache memory, I/O organizations. Architectural view of microprocessor-based systems. Detailed descriptions of the components; electronics, functions and interfaces. System bus. Interrupts; DMA and I/O interfacing techniques.

CCE 524: Operating Systems **3 units**

Basic concepts of operating systems; processes; interprocesses communication and synchronization; input-output; file systems; memory management.

Real time operating systems. Real time systems and embedded system applications

ME 406: Industrial Engineering **3 units**

Modern methods applied to facility layout and location design are discussed. Logistics of motion, people, materials, flow analysis, plant layout, and material handling techniques are covered sequencing and scheduling of job shops, flow lines and other general manufacturing and production systems. Visual and micromotion study techniques, motion economy, time study and work sampling. The development and use of standard time data and computerized techniques will be covered.

CCE 526: Structural Engineering **3 Units**

Analysis of trusses by method of joints. Joints under special loading conditions. Space trusses. Analysis of trusses by the method of sections. Trusses made of several simple trusses. structures containing multiforce members. Analysis of a frame. Frames which cease to be rigid when detached from their supports. Machines. Internal forces in members. Various types of loading and support of beams. Shear and bending moment in a beam. Cables with concentrated loads. Cables with distributed loads. Parabolic cables. Catenary

CCE 312 Microprocessor Technologies II

The 68000 Microprocessor: architecture and structure, modes, interfacing, clock input and waveform, internal registers, instruction set, instruction execution and control. 68000 microprocessors programming: S/W model, operand addressing modes, memory and I/O interfacing, 68000 microprocessors design and engineering, the MPU, applications and management.

CCE 31X TCP/IP

Review of the repertoire of communications protocol, functions and functioning of protocols, networking basics, networking with TCP/IP, installation and configuration, IP addressing and subnetting, IP routing, DNS, FTP, connectivity, optimization, troubleshooting and Management.

EA 31X Engineering Management Science II

Marginal and sensitivity analysis: what-if analysis, optimality sensitivity analysis, feasibility sensitivity analysis, Decision analysis: decision trees, utilities, probabilistic methods. Forecasting: univariate and multivariate methods, AR, ARMA and ARIMA techniques. Engineering Economic analysis: present and future worth analyses, need and requirement analyses, situation and replacement analyses, maintenance and reliability.

DAS 31X Total Systems Engineering

Review of Systems science, systems approach, review of Total systems concept, Concept of Totaling, systems notion, systems methodology, systems analysis and synthesis. Elements of systems engineering, systems modeling, systems simulation, Systems optimization, systems feasibility, systems maintenance and reliability, validity and verifiability, value analysis, value added, value chains, value engineering, quality concepts, Deming's and Tanenbaum quality analysis, Improvement concepts, change and opportunity concepts, performance optimization and management, Total quality engineering, business systems and process engineering, engineering technologies.

ME 508 Industrial Maintenance Engineering

Review of industrial and Management engineering, production planning and scheduling, industry ergonomic design and engineering. Detailed treatment of Concepts in plant engineering, engineering safety, factory maintenance and occupational safety, maintenance and reliability engineering, plant need and requirement analysis, machine replacement analysis, systems reliability engineering, industrial maintenance strategies, manufacturing process maintenance including concurrent, simultaneous and reengineering applications and implications. Plant reliability, maintainability and availability, QA/QC techniques, forecasting, SPC, maintenance and control of quality in industry, CIM in manufacturing and maintenance engineering. Techniques in designing and implementing maintainable and reliable industrial systems and processes, Engineering economic analysis including material depreciation analysis and inventory management.