

Course Descriptions

Course Descriptions CIE101
(1-0-1, 1)

Introduction to Civil Engineering

Course Description:

This course introduces civil engineering students to the broad field of Civil Engineering such as environmental, geotechnical, hydrology, water and waste water, structural design, high-rise buildings, construction engineering, and highways fields and assists them in determining the areas of emphasis they might want to follow for their bachelor's degree. Introduction to Engineering Design (Design Process and Working in Teams). Technical Communication Skills (Written and Oral). Introduction to Engineering Ethics and Professionalism. Demonstrate knowledge of career opportunities in the field of civil engineering. Introduction to management and leadership skills and public policy.

Prerequisites: None

CIE 102
3)

Report Writing and Presentation

(3-0-1,

Course Description:

Introduction, abstraction, audience and purpose, report writing and audience, ethical considerations in report writing, technical definitions, description of a mechanism, description of process, technical proposals, progress reports, feasibility and recommendation reports, laboratory and project reports, instructions and manuals, research reports, questionnaires for survey, abstract and summaries, grammar, style and punctuation, documentation, visuals, presentations, business communications, resume and cover letters.

Prerequisites: None

CIE 211
3)

Statics

(3-0-2,

Course Description:

The course (Statics) introduces knowledge and understanding of vector resultant of forces in two and three dimensions; type of structural supports; equilibrium of particles and rigid bodies; analysis of internal forces in beams and trusses; static and kinetic friction; centroids of lines, areas and volumes; moments of inertia.

Prerequisites: PHY121

CIE 112
3)

Civil Engineering Drawing

(1-4-0,

Course Description:

Introduction to engineering drawing, Scales, Dimensioning, Types of lines, Construction geometry, Theory of Orthographic Projection, Pictorial drawing, Sections and Introduction to computer Aided Drafting (AutoCAD), computer graphics documentation for civil engineering- and construction-related professions, which involve introduction to graphic standards using hand drawn sketches as well as computer aided drawings that focus on graphical communications.

Prerequisites: None

CIE 213 3)	CAD for Civil Engineering	(1-4-0,
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Course Description:

The course is an interdisciplinary course for all Civil Engineering specializations. It provides freshmen students with the basic computer skills that help them to master the computer use for the fields of professional practice and studio projects, 2D and 3D drawing, presentation and visual communication. The course also lays the foundation for other advanced departmental computer course applications. This course includes geometric construction; line convention; elevations; perspective projections; dimensioning, and sectional views utilized in the preparation of drawings in civil and infrastructure engineering.

Prerequisites: CIE 112

CIE 201	Programming for Engineers	(2-2-1, 3)
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Course Description:

The course introduces the basic concepts of computer programming with C++ and involves practice at basic to intermediate level utilizing fundamentals and main features and procedures such as problem solving and flow charts, data types, input, output and control statements. Use of functions, arrays and strings is also practiced with engineering problem solving assignments.

Prerequisites: COM111

CIE 212 3)	Mechanics of Materials	(3-0-2,
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Course Description:

Explanation of the response of engineering materials in terms of deformations when subjected to forces. Understanding the meaning of stress and strain terminologies. Formulation of relations between stresses, deformation, strains and applied forces. Using statics to analyses

determinate beams. Understanding the internal forces developed in beams.

Prerequisites: CIE 211, MTH122

CIE 222
4)

Civil Engineering Materials

(3-2-0,

Course Description:

To familiarize the students with different types and properties of various materials used in the civil engineering construction projects (such as cement, aggregate, asphalt cement). Familiarize the students with concrete and its constituents (cement, aggregates, water), cement manufacturing, cement hydration (physical and chemical properties), fresh and hardened concrete properties including tests for classifying fresh concrete (e.g. consistence), destructive tests for hardened concrete (e.g. compressive strength, tensile strength, etc.) Fresh and hardened concrete deformations, concrete durability, concrete curing, and concrete admixtures.

Familiarize the students with asphalt cement and its types and characteristics, perform different tests on asphalt cement such as penetration, ductility, viscosity and specific gravity.

Familiarize the students with aggregate types and characteristics and perform some tests on it to obtain its properties such as gradation and physical properties. Several types of other construction materials such as wood, steel and glass will be introduced.

Prerequisites: CHE101, co CIE 212

CIE 241

Surveying I

(2-2-0, 3)

Course Description:

Errors in measurements. Horizontal and vertical distance measurements, leveling / topographical and terrain elevations changes, topographic surveys, using topographical surveys to calculate areas and volumes; Setting out horizontal and vertical control benchmarks and use of surveying equipment such as Levels and Theodolites.

Prerequisites: MTH121

CIE 242

Transportation Engineering

(3-0-0, 3)

Course Description:

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.

Prerequisites: CIE 241

CIE 331
3)

Structural Analysis I

(3-0-0,

Course Description:

Internal axial forces in the members of statically determinate trusses, deflections in beams and trusses, internal forces in three hinged arches, influence lines of statically determinate structures.

Prerequisites: CIE 212, MTH222

CIE 332

Structural Analysis II

(3-0-0, 3)

Course Description:

Determinacy and indeterminacy of structures. Stability of structural systems. Methods for solving indeterminate structures. Shear force, bending moment and elastic lines diagrams. Use of models to analyze structures.

Prerequisites: CIE 331

CIE 334
3)

Design of Reinforced Concrete Structures

(3-0-2,

Course Description:

Introduction to building in “reinforced concrete”. Introduction to the behavior of reinforced concrete sections, reinforced concrete members & reinforced concrete frames. Introduction to international codes of practice for the design of reinforced concrete buildings. A computer application on structural analysis and reinforced concrete design of various structural elements. A suitable software will be chosen for this purpose (such as STAAD PRO or ETABS).

Prerequisites: CIE 331, CIE 222

CIE 336 Computational Methods and Software Systems for Design of Structures (1-4-0, 3)

Course Description:

This course aims at introducing topics based on the recent developments and advances in structural and RCC design engineering. It includes topics related to the analysis and design of structural systems through the use of computers. Use of computer software such as SAP, ETABS and STADPRO.

Prerequisites: CIE 201, CIE 331

CIE 342
3)

Highway Design

(3-0-0,

Course Description:

Introduction into different types of highways, principles of route location. Horizontal alignment; design and setting out (circular curve element, setting out of circular and transition curves, superelevation. Sight distance; stopping and passing sight distance. Vertical alignment; design and setting out (properties of vertical curves). Coordination of horizontal and vertical curves. Capacity of multilane highways. Geometric design of intersection and interchanges. Highway materials, mixtures and pavement design.

Prerequisites: CIE 242, CIE 222

CIE 351

Fluid Mechanics

(3-2-0, 4

Course Description:

Fundamental concepts and properties of fluids; fluid statics, units and measurement of pressure; forces on planar and curved surfaces, and buoyancy; kinematics of fluid motion; conservation equations with applications; continuity, momentum and energy equations, and Bernoulli's equation; velocity and flow rate measurements; dimensional analysis and modeling; frictional losses in pipes and introduction to fluid dynamic forces on immersed bodies.

Prerequisites: CIE 211

CIE 352

Environmental Engineering

(3-0-0, 3)

Course Description:

Sources of pollutants and their effects on environment. Collecting treating and disposing off the treated waste. Fundamentals of water supply engineering for provision of a potable water supply.

Design for water treatment unit, operation and design of water distribution network and plumbing system. Air pollution control, noise pollution measurement and control, and environmental impact assessment.

Prerequisites: ENV111, CHE101

CIE 354
3)

Hydrology and Water Resources

(3-0-0,

Course Description:

Introduction to the hydrological cycle and its various components. Relevant hydrological information and methods of measurements of hydrological variables. Hydrological assessment and design. Groundwater flow, geological structure, groundwater contamination, regional circulation, aquifers, recharge, and flow nets.

Prerequisites: CIE 351

CIE 361
3)

Geotechnical Engineering I

(2-2-0,

Course Description:

Soil formation, composition types, physical properties of soils, soil classification and testing. Flow of water through soil, soil analysis and site investigation to determine the properties of soils and their bearing capacity; distribution of stresses in soils and the potential for differential settlement; soil classification factors to be considered in foundation design, lateral earth pressure and retaining walls, water flow in soils, soil compaction, consolidation and consolidation settlement, shear strength of soils, and slope stability.

Prerequisites: CIE 222, CIE 212

CIE 371
3)

Engineering Economics

(3-0-0,

Course Description:

Introduction to microeconomics, competition and monopoly, labor markets, macroeconomics, world trade and the balance of payments, basics of financial accounting and project appraisal and economic feasibility of engineering projects, income measurement, capital investments, equipment alternative analysis and equipment replacement studies.

Prerequisites: MTH122, STA112

CIE 431
3)

Design of Steel Structures

(3-0-0,

Course Description:

Introduction to steel structures and practical design methods. Steel sections. Load factors and load combinations. Design of various steel elements using LRFD-method. Design of tension and compression members, Elastic and inelastic stiffness of columns. Beam design: Compact section criterion, lateral-torsional buckling, lateral supports, and various design aspects of beams. Design of steel members subject to biaxial moments. Design of simple bolted (or welded) steel connections. A software will be used for steel analysis and design.

Prerequisites: CIE 331

Course Description:

Introduction; types and documents of tenders; types of construction contracts; bonds and insurance requirements; local and International general conditions and obligations of construction contracts; preparation of specifications; regulations pertinent to buildings, construction works and building materials; quantity surveying and bill of quantities; rights and obligations of engineering consulting offices. Study of estimating and costing of civil engineering projects. Cost estimation process. Elements of the project costs. Case studies. BIM software will be used for estimating at different phases of construction.

Prerequisites: CIE 213, CIE 334

Course Description:

Construction Management for Civil Engineering, Contract Management, Project Management. Culture and global business (managing cross-cultural differences in projects, impacts of cultural differences on project success in construction). Project delivery systems, types of contracts, planning and scheduling using CPM network methods (CPM and PDM) as well as tracking and progress reporting using the earned value method (EVM). Quality assurance, Safety and Health in Construction. BIM Software system will be available to students to learn how to generate project schedule.

Prerequisites: CIE 334, CIE 471

Course Description:

The course is aimed at the development of conceptual and applied design skills through discussions, meetings and laboratory work involving the completion of a civil engineering design project. Graduation project include multiple major aspects of the civil engineering profession (such as structural, transportation, geotechnical, water and Environment) and require the use of engineering software for project management such as MS project and Primavera Project Planner.

The project experiences is intended to develop students skill in problem solving, team work, design, innovation, use information technology, engineering, ethics, and social responsibility.

Students are expected to complete a design project that demonstrates the skills and knowledge gained through applying engineering principles to solve a design problem.

Students work in teams of three to four to solve an engineering design problem. Every team is required to choose a real-world project. Teams are supervised by faculty members and instructors who oversee, guide and monitor progress in the project.

Every group is required to maintain a record of all project activities in a project logbook which will be inspected regularly by the project supervisor.

Prerequisites: CIE 334, CIE 342, CIE 371, CIE 352, CIE 361 Completion of 90 credit hours

CIE 492
(3)

Graduation Project I I

Course description:

Graduation project II is a capstone course that combined all previous courses in one task of designing a civil engineering project. Graduation project includes one hour of theoretical instructions by the supervisor and at least four hours per week on design/analysis activities that may include work on various relevant software, or work on drawing or CAD studio to prepare the engineering plans for the specified project.

The course is aimed at the development of conceptual and applied design skills through discussions, meetings and various activity work (analysis/design) involving the completion of a civil engineering design project. The project experiences is intended to develop students skill in problem solving, team work, design, innovation, information technology, engineering, engineering ethics, and social responsibility.

Students are expected to complete a design project that demonstrates the skills and knowledge gained through applying engineering principles to solve a design problem. Students work in teams of three to four to solve an engineering design problem. Every team is required to choose a real-world project. Teams are supervised by faculty members and instructors who oversee, guide and monitor progress in the project.

Every group is required to maintain a record of all project activities in a project logbook which will be inspected regularly by the project supervisor.

Prerequisites: CIE 491

CIE 499

Engineering Training

(4)

Course description:

Practical training is an important part of engineering student education. It will help him to relate the theoretical knowledge learned in classrooms to solutions of real-world problems, experience the working environment before graduation, and learn how to act responsibly and efficiently in carrying out assigned tasks, etc.

Prerequisites: Completion of 75 credit hours

CIE 481
3)

Advanced Structural Analysis and Design

(3-0-0,

Course Description:

To demonstrate the knowledge of the Limit States theory, the method of design of reinforced concrete buildings-ultimate limit states & serviceability limit states. The concept of "redistribution of moments" Design different types of reinforced concrete floor systems-Slab & beams, Ribbed slab & Flat slab. Design different types of reinforced concrete

columns- short & slender columns under axial load & bending moment. Design of Combined footings, Strip Foundations and introduction to the design of Raft Foundations. Complete design calculations and design drawings of a multistory reinforced concrete building to an international code of practice. Classification of nonlinear problems in structural analysis.

Prerequisites: CIE 332, CIE 334

CIE 482
3)

Pre-Stressed Concrete

(3-0-0,

Course Description:

Basic principles, short- and long-term properties of constituent materials, partial prestressing. Flexural behavior, analysis and design of prestressed concrete beams, classes, cracking, pretensioning, post-tensioning, service load design, load balancing, strength design, strain limits, flexural efficiency. Bond, transfer and development lengths, anchorage zone design. Shear and diagonal tension. Evaluation of immediate and long-term losses. Composite construction and design, shear-friction theory. Deflection calculation using approximate single time step approach.

Prerequisites: CIE 334, MTH222

CIE 483
3)

Traffic Engineering

(3-0-0,

Course Description:

Traffic flow theory, volume, speed, delay, parking and safety studies, Traffic control devices, capacity analysis of signalized and unsignalized intersections, Capacity analysis of two-lane highways, multi-lane highways, and freeways. Roundabout capacity and traffic impact analysis.

Prerequisites: CIE 242

CIE 484
3)

Pavement Materials and Design

(3-0-0,

Course Description:

Introduction to the principals of pavement design for safety, serviceability and structural adequacy. Understand pavement engineering, terminology, and concepts. Know the different types of pavements. know and understand the engineering properties and characteristics of different materials that concern the pavement engineer such as soil, granular, and bituminous materials. Get familiar with different Superpave aggregate and asphalt binder tests and requirements. Design asphalt concrete mixture. Pavement performance, design flexible and rigid pavements using the AASHTO design procedure. Conduct analysis of flexible pavements for stresses, strains, and deflections in one-, two-, and three-layered systems.

Prerequisites: CIE 242

CIE 485
3)

Surveying II

(3-0-0,

Course Description:

Enhance the knowledge of advanced equipment, methods and their application in the field of engineering. To learn the surveying operations involved in different civil engineering projects. Laying out control lines for curves, use of Total Stations, GPS control systems, GIS Systems, and Digital scanners.

Prerequisites: CIE 241

CIE 486

Geotechnical Engineering II

(3-0-0, 3)

Course Description:

Description of wide range of methods which are used in practice to improve the engineering properties of soils. soil compaction, principle of effective stress, stresses due to self-weight, stresses due to applied loads, soil permeability, seepage: one and two dimensional, flow net, consolidation theory and consolidation settlement analysis: immediate and consolidation settlement, secondary compression, shear strength of soils. Developing an understanding of the mechanics of piled foundations in soft soils and to use that knowledge for design purpose. Purposes, scope and conduct of site investigation procedures.

Prerequisites: CIE 361

CIE 487
3)

Solid and Hazardous Waste Management

(3-0-0,

Course Description:

Function elements of solid waste management processes, Traditional versus integrated options for solid waste management, Physical and chemical characteristics of solid waste, Hazardous waste regulatory aspects, Characterization of hazardous waste, Treatment and disposal options of hazardous waste. Solid waste management in landfill and ultimate disposal practices. Risk assessment and risk management.

Prerequisites: CIE 352

MTH121
3)

Engineering Mathematics I

(3-0-2,

Course Description:

- Limits - Definition of the limit of a function, theorems about limits, evaluation of limit at a point and infinity, continuity.
- Derivatives - Derivatives of algebraic and trigonometric functions, applications of derivatives, maxima and minima. Applications of derivatives in engineering.
- Integration- The definite and indefinite integrals and their applications: anti-derivative, definite integrals, area between two curves, volumes, length of a plane

curve, average value of a function, etc. Integration by parts, integration using powers of trigonometric functions, integration using trigonometric substitution, integration by partial fractions. Integration of improper integrals. Utilization of software package (such as MathCAD or MATLAB) for performing integration. Applications of engineering.

- Transcendental functions -Differentiation of trigonometric functions, inverse trigonometric functions, logarithmic functions, exponential functions, hyperbolic functions, and inverse hyperbolic functions.

Prerequisites: None

MTH122

Engineering Mathematics II

(3-0-2, 3)

Course Description:

- **Matrix Computation:**
Matrix addition, subtraction, multiplication and transposition. Inverse of Matrix.
- **Complex Numbers:**
Definition of complex numbers, algebraic properties of complex numbers, absolute values, complex conjugate, polar representation, powers and roots.
- **Functions of Several Variables:**
Functions of several variables, partial derivatives, applications.
- **Multiple Integrals:**
Polar coordinates, double and triple integrals in rectangular and polar coordinates. Applications of multiple integrals in engineering.
- **Numerical Sequences and Series:**

Definitions, sequences of real numbers, tests for convergence, power series expansion of functions, Taylor series of a given function, Laurent series, Fourier series, and their applications in engineering.

Prerequisites: MTH121

MTH221

Engineering Mathematics III

(3-0-2, 3)

Course Description:

- Vector Calculus:
- Vectors in the plane, dot and cross products, lines and planes in space, polar coordinate system, line integrals, Green's theorem, surface integrals. Engineering applications of vector calculus.
- Ordinary Differential Equations:
- First order differential equations, application examples of first order equations. Homogeneous linear second-order differential equations with constant and variable coefficients, non-homogeneous linear second-order differential equations with

constant coefficients, higher-order linear differential equations with constant coefficients, application examples. Power series solution of differential equations.

- Laplace Transformation:
- Laplace Transform, Inverse Laplace Transform, Laplace Transform of derivatives and integrals, using Laplace Transform to solve ordinary differential equations, examples and applications. Unit step function, periodic functions, and table of some Laplace Transforms. Applications of Laplace Transformation in engineering.
- Partial Differential Equations:
- Introduction to partial differential equations (PDE), first order PDE (linear and non-linear), second order PDE, boundary value problems, engineering applications.

Prerequisites: MTH122

MTH222

Engineering Mathematics IV

(3-0-2, 3)

Course Description:

- **Complex Analysis**

Complex functions, derivative of complex functions, analytic functions, Cauchy-Riemann equations, harmonic functions. Engineering applications of complex analysis techniques.

- **Fourier Analysis**

Fourier Series, Fourier Integrals, Fourier series of even and odd functions with applications.

- **Linear Algebra**

Matrices and determinants, solution of systems of linear equations, eigenvalues and eigenvectors, engineering applications, computer exercises.

- **Discrete Mathematics**

Review of sets and relations. Introduction to basics of discrete mathematics and its engineering applications.

Prerequisites: MTH221

MTH321
3)

Engineering Mathematics V

(3-0-2,

Course Description:

To introduce the students, the fundamentals of probability, random variables, and random processes so that they can deal with randomness and uncertainty involved processes and systems.

Prerequisites: MTH222

Course Description:

- Vectors, Motion and Newton's Laws

Vectors, Motion in one, two and three dimensions. Newton's Laws of motion and their applications.

- Work, Energy and Momentum

Work, kinetic energy, potential energy, conservation of energy, momentum and collisions.

- Rotation of Rigid Bodies

Angular velocity and acceleration, rotation with constant angular acceleration, relating linear and angular kinematics, energy in rotational motion.

- Dynamics of Rotational Motion

Torque, rigid-body rotation, work and power in rotational motion, angular momentum, conservation of angular momentum. Applications in engineering.

- Equilibrium and Elasticity

Conditions of equilibrium, center of gravity, solving rigid-body equilibrium problems. Stress, strain, and elastic moduli. Applications in engineering.

- Periodic Motion

Oscillations, simple harmonic motion, applications of simple harmonic motion.

Prerequisites: None

Course Description:

- **Electric Charge and Electric Field**

Electric charge, Coulomb's law, electric-field and electric forces, electric-field calculations. Electric flux, Gauss's law, applications of Gauss's law. Electric potential.

- **Capacitance**

Capacitance and dielectrics, capacitors in series and parallel, energy storage in capacitors.

- **DC Circuits**

Electric current, resistivity, resistance, electromotive force, Ohm's law, energy and power in electric circuits, Kirchhoff's laws, analysis of simple DC circuits. Applications in engineering.

- **Magnetic Fields**

Magnetic field lines and magnetic flux, motion of charged particles in a magnetic field and its applications, magnetic force on a current-carrying conductor and its applications, the Hall effect. Sources of magnetic field. Ampere's law and its applications. Applications in engineering.

- **Electromagnetic Induction**

Electromagnetic induction, Faraday's law, Lenz's law, induced electric fields. Applications in engineering.

- **Inductance**

Mutual- and self-inductance, inductors in series and parallel, magnetic-field energy.

- **Electromagnetic Waves**

Maxwell's equations and electromagnetic waves, the electromagnetic spectrum. Applications in engineering.

- **Optics**

The nature of light, reflection and refraction, total internal reflection, dispersion, polarization, scattering of light, Huygens' principle, interference, diffraction, holography. Types of lens and mirrors and their applications in engineering.

Prerequisites: PHY121

CHE101 4)	Chemistry for Engineers	(3-2-2,
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Course Description:

- **Introduction**

Atoms, molecules and ions; formulas of ionic compounds, names of compounds, hydrates, problems.

- **Electronic structure and the periodic table**

Hydrogen atom, quantum numbers, energy levels and orbitals.

Electron configurations in atoms and monatomic ions. Orbital diagrams of atoms, problems.

Periodical trends in the properties of atoms, problems.

- **Types of bonds**

Ionic bond, covalent bond, atomic orbital, molecular orbital, hybridization.

- **Chemistry of the metals and semiconductors**

Metallic bonding, band theory, chemistry of semiconductors and applications, solar cell, diodes, superconductors and ceramics.

Reactions of alkali and alkaline earth metals, detergent, redox reactions, galvanic cells and batteries. Chemistry of transition metals, complex ions, coordination compounds, composition, naming, geometry, chelates, ligands, coordination

number, charge of the complex ions. Solubility product K_{sp} , precipitation of metals, qualitative analysis of metal ions.

- **Introduction to organic chemistry**

Bonding and types of hybridization in carbon atom, alkanes and cyclo-alkanes, nomenclature, alkyl and halogen substituents, conformation of ethane, halogenation of alkanes, free radicals problems.

- **Alkenes and alkynes**

Nomenclature, cis-trans isomers, electrophilic addition reactions, Diels-Alder reaction, problems.

- **Polymer**

Introduction to polymers, polymerization, types, properties and uses of polymers.

Prerequisites: None