

BS in Civil and Infrastructure Engineering

Course Description

CIEN 201 Computer Aided Drawings (1:6:0)

3 Semester Credit Hours - Pre-requisite(s): None

Introduction to computer graphics. Includes the following topics: geometric construction; line convention; orthographic projections, isometric projections; oblique projections; Descriptive projections; dimensioning, and sectional views. Computer-aided design and problem-solving techniques. Uses computer software AutoCAD in data analysis, data display and visualization techniques. Prepare drawings in civil and infrastructure engineering.

CIEN 211 Statics (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): MATH 113 and PHYS 110

Vectors, force systems (2D and 3D), equilibrium of particles and rigid bodies (2D and 3D), structures (trusses, cables, frames and machines), distributed forces (centroids and centers of mass), internal forces (shearing force and bending moment diagrams), friction, and moment of inertia.

CIEN 212 Mechanics of Materials (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 211

Types of loads, axial stress and strain of determinate and indeterminate system, normal and bending moment diagrams, torsion of determinate and indeterminate system, bending of beams, combined stresses, shearing stress and strain, Mohr's circle of stress and strain, thin walled pressure vessels.

CIEN 241 Infrastructure Management (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ECON 103

An introduction to infrastructure management systems, including management process, data collection technologies, interdependence, benchmarking and best practices. Other related issues, such as, resilience security of infrastructure systems are addressed.

CIEN 250 Engineering in Global Environment (2:0:0)

2 Semester Credit Hours

Introduction to environmental engineering as practiced in different societies around the world. Defining environmental engineering as organizational and physical infrastructure to manage natural resources. Focuses on how different societies respond to environmental challenges related to engineering opportunities. Identify and explain the global, economic, environmental, and societal impacts of specified civil and infrastructure engineering systems. Issues for sustainability in engineering practice. Include case studies of sustainable engineering in developing and developed world.

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CIEN 251 Fluid Mechanics (3:0:0)

2 Semester Credit Hours - Pre-requisite(s): MATH 213 & CIEN 211 (Civil Engineering) and MATH 114 and PHYS 110 (Mechanical Engineering)

Properties of fluids, flow regimes, pressure and force calculations under hydrostatic conditions, manometers, buoyancy and stability of floating and submerged bodies, elementary fluid dynamics, conservation equations: mass, energy and momentum, continuity and Bernoulli equations. Boundary layer theory, fluid flow in conduits and determination of head loss in pipes.

CIEN 261 Surveying (0:3:0)

1 Semester Credit Hour - Pre-requisite(s): CIEN 201

Principles of surveying by conducting tests on distance measurements, levels and theodolites, directions and angular measurements, topographic surveys, areas and volumes; traverse surveys; Setting out horizontal and vertical curves, Training on Total Station.

CIEN 265 Geographic Information System (GIS) (1:3:0)

2 Semester Credit Hours - Pre-requisite(s): CSCI 112

This course exposes students to the principles of GIS (hardware, software, people, data, and methods) and its environmental and infrastructure management applications. Subjects also include the acquisition and compilation of data from maps, field surveys, air photographs and satellite images. The course includes hands-on GIS state-of-the-art software.

CIEN 301 Numerical Analysis (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): MATH 214 and CSCI 112

Matrix Algebra: Matrix operations, inverse, determinant, Eigen vectors, Eigen Values and solutions of systems of linear equations. Application of computers to solve engineering problems using various numerical methods, mathematical modeling and error analysis, solution of algebraic and differential equations, numerical differentiation and integration and curve fittings. Presents application examples from civil and infrastructure engineering, industrial engineering and mechanical engineering.

CIEN 311 Structural Analysis (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 212

Structural forms, reactions, determinate structures, degree of determinacy, shear and moment diagrams for beams and frames, influence lines for beams, deflections (principle of moment area theorems, virtual work

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and conjugate-beam methods), Analysis of indeterminate structures by moment force method, slope-deflection method and distribution method.

CIEN 321 Reinforced Concrete Design (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 311 and CIEN 331

Properties of concrete and steel, cracked and uncracked section analysis, strength design, stress block, design for bending and shear, singly, doubly reinforced sections, rectangular sections, and T-sections, load cases and moment envelopes, bond requirements, development length and bar cutoffs, one-way solid and one-way ribbed slabs, design of short columns.

CIEN 331 Construction Materials (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 212 and CHEM 211

Cement (types, manufacture, properties and hydration), aggregates, fresh concrete, hardened concrete (strength, strength development, shrinkage, creep), concrete in severe environment (hot and cold), durability, mix design by ACI and DoE methods, use of masonry, fiber reinforcement and metal form decking and structural steel joists.

CIEN 332 Construction Materials Lab. (0:3:0)

1 Semester Credit Hour - Pre-requisite(s): CIEN 212, CHEM 211 Co-requisite: CIEN 331

Introduction to testing & specifications, concrete and mortar tests, aggregate testing, fresh and hardened concrete testing, non-destructive tests, design & testing of concrete mixes, brick testing, tests on steel reinforcing bars.

CIEN 333 Geotechnical Engineering (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 212 and CHEM 211

Index and classification of soils, water flow in soils (one and two dimensional water flow), soil stresses, soil compaction, distribution of stresses in soil due to external loads, consolidation and consolidation settlement, shear strength of soils, slope stability.

CIEN 334 Civil Engineering Testing and Materials (0:3:0)

1 Semester Credit Hour - Pre-requisite(s): CIEN 331, CIEN 333

Co-requisite: CIEN 361

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Tests on soils: specific gravity, grain size distribution, consistency limits, coefficient of permeability (constant and falling head), consolidation test, direct shear and tri-axial and CBR. Tests on fluids: Center of pressure, orifice and jet flow, Pressure variation in flowing fluid, momentum principle, flow through pipelines and closed conduits. Tests on asphalt properties, and marshal mix design. **(Writing Intensive Course)**

CIEN 351 Environmental Engineering (2:0:0)

2 Semester Credit Hours - Pre-requisite(s): CIEN 251, CHEM 211

Introduces principles of environmental engineering management and design pertaining to water supply and treatment, wastewater treatment, solid waste management, air pollution control, noise pollution measurement and control, and environmental impact assessment. Includes case studies from UAE.

CIEN 361 Highway Engineering and Design (3:0:0)

2 Semester Credit Hours - Pre-requisite(s): CIEN 331

Pavement types; Materials used in flexible pavement layers (soil, aggregate, and asphalt); Calculation of Equivalent Standard Axle Loads (ESAL); flexible pavement thickness design, Hot Mix Asphalt (HMA) design; Highway construction operations; highway performance.

CIEN 362 Transportation Engineering (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 261

Role of transportation engineering; Transportation system issues and challenges; Modes of transportation, Main components of highway, mode of transportation (driver, pedestrian, traffic, road); Geometric design of highways and highway facilities; Highway functional classification and special facilities; Intersection design and control. Introduction to rail, air, and water transportation.

CIEN 421 Structural Steel Design (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 311

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, beam design: Compact section criterion, lateral-torsional buckling, lateral supports, and various design aspects of beams. Beam-column elements, design of column base plates, design of simple bolted (or welded) steel connections.

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CIEN 422 Advanced Reinforced Concrete Design (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 321

Structural layout, estimation of dead and live loads, serviceability, deflections and crack control, design for torsion, design of frames, moment redistribution, slender columns, approximate methods for two-way slabs, detailing of reinforcement.

CIEN 424 Bridge Design (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 321

Covers design of highway bridges; history, classification and aesthetics of bridge structures; design philosophy; loading, girder distribution factors; and load combinations; design of concrete deck slab; design of reinforced concrete T-beam and box girders bridges; and design of piers, bearings and abutments. Introduces pre-stressed concrete bridges.

CIEN 431 Foundation Engineering (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 333

Site investigation, bearing capacity of shallow foundation, distribution of stresses in soils, settlement of shallow foundation, factors to be considered in foundation design, introduction to deep foundation, lateral earth pressure and retaining walls.

CIEN 440 Infrastructure Financing (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 241

Fundamentals of infrastructure project financing, Public Private Partnerships (PPP), Build Own Transfer (BOT), variation models, financing structures, framework, bonds, life cycle analysis, sponsors and risk management.

CIEN 441 Construction Management (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 331

Basic concepts of construction project management, Construction planning, project time Management, project cost management, project quality management, value engineering and project life cycle, construction process optimization, construction contracts, contracting methods, project specifications, bidding, procurement methods and contractor applications for payment procedures.

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CIEN 442 Construction Planning and Scheduling (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 441

Principles of planning, monitoring, and controlling construction projects. Developing schedules using bar charts, precedence diagrams, program evaluation and review techniques (PERT), and linear schedules. Resource histograms and s-curves. Resource allocation and resource leveling. Schedule constraints. Earned value concept. Includes MS project and Primavera Project Planner software.

CIEN 444 Construction Cost Analysis and Estimating (3:0:0)

Semester Credit Hours - Pre-requisite(s): CIEN 441

Perceptions of construction cost, engineering economic analysis, risk and uncertainty, range estimating, cost fundamentals, types of cost estimating, estimating construction materials cost, estimating construction labor cost, direct versus indirect costs, estimating construction equipment cost, cost of concrete structures, estimating project cost, time/cost trade-off analysis and contractor general requirements.

CIEN 451 Infrastructure Systems (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 351 and CIEN 362

Role of planning, system demands and networking in infrastructure systems, energy systems, water and waste water infrastructure, transportation systems, waste disposal and resources conservation, smart growth and effects of infrastructure on the environment, models of creating sustainable future development, planning, design and architecture in sustainable communities, and integrated infrastructure system models.

CIEN 454 Water and Wastewater Supply (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 351

Sources of water, requirements for water supply projects, population's studies, rates of water consumption, variation in water demand, collection and distribution of water, distribution networks. Sources of wastewater, quantities and quality, sewage collection works, sewage purification works and disposal, primary treatment, secondary treatment, activated sludge system, design of sewer systems.

CIEN 455 Solid Waste Management (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 351

Evolution of solid waste management, integrated approach to solid waste management, sources, composition, and properties of solid waste, physical, chemical and biological properties of MSW and household hazardous wastes. Waste handling, separation, storage and collection. Building a sustainable future, application of life-cycle analysis to waste management systems, reuse technologies, energy recovery from liquid and solid wastes and product recovery from oily wastes.

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CIEN 456 Sustainable Urban Building Sites (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 351

Concept of sustainability, how sustainability applies to infrastructure projects and programs, measuring sustainability, identification and design of sustainable technologies associated with water and energy management for infrastructure projects, green buildings and sustainable housing, sustainable transportation, energy, use of materials and waste management and water use. Includes case studies in sustainability.

CIEN 462 Advanced Pavement Design (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): CIEN 361

Pavement types, Pavement materials; subgrade stabilization methods; Principles of mix design using SUPERPAVE; Analysis of stresses in flexible and rigid pavement, Design methods of highway flexible and rigid pavements; Overlay design, Computer applications.

CIEN 464 Airport Planning and Design (3:0:0)

3 Semester Credit Hours - Co-requisite(s): CIEN 362

Examines airport master planning, forecasting air travel demand and sustainable design of airports, including lighting, terminal facilities, noise-level control, aircraft control, airspace utilization and automobile parking.

CIEN 491 Senior Design Project (1) (0:6:0)

2 Semester Credit Hours - Pre-requisite(s): Senior Standing

Preparation and starting of project in civil and infrastructure engineering. The project is a multidisciplinary interaction for infrastructure design and management that includes system analysis and inculcates sustainable engineering principles. Includes use of engineering software especially project management such as MS project, Primavera Project Planner and CYCLONE.

CIEN 492 Senior Design Project (2) (0:12:0)

4 Semester Credit Hours - Pre-requisite(s): CIEN 491

Continuation of the senior design project I. The project is a multidisciplinary interaction for infrastructure design and management that includes system analysis and inculcates sustainable engineering principles. Includes use of engineering software's especially project management software such as MS project, Primavera Project Planner and CYCLONE, writing a technical report and developing project drawings, specifications and details.

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CIEN 493 Special Topics in Civil and Infrastructure Engineering (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): Department Consent

Special up-to-date topic in the civil and infrastructure engineering.