

COURSE OUTLINES: BSC IN CIVIL ENGINEERING

FEATURES OF REVISION IN SUMMER 2008

- Course contents have been revised to fit into 39 hours of class meetings in a semester (for 3 credit hour courses).
- Course contents have been divided into three segments to facilitate determining syllabi in Midterm I, Midterm II and Final exams.
- CE 337, CE 361 and CE 363 courses have been thoroughly revised.
- Outline of BUS 201 course has been detailed more elaborately.
- “Deflections of beams” has been moved from CE 231 to CE 335.
- CE 331 and CE 333 courses have been made complementary to each other by redesigning the contents.
- MATH 105 course has included more topic on two-dimensional geometry.
- CE 223 course has included more on atomic structures and mechanical properties of materials.
- CE 471 and CE 321 courses have been modified for completeness.

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MATHEMATICS

MATH 101 Calculus: 3 credits 3 hours/week

Limit, continuity and differentiability, Geometric interpretation of differentiation and its application; Differentiation of functions; successive differentiation of various types of functions, evaluation of indeterminate forms by L'Hospitals rule; Leibnitz's theorem, Roller's theorem, mean value theorems,

Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders, Cauchy's form of remainders; Expansion of functions by differentiation and integration; maximum and minimum values of functions; Partial differentiation, Euler's theorem; Integration by the method of substitution, standard integrals,

Integration by successive reduction, definite integrals, its properties and use in summing series. Application of integration, determination of length, area and volume. Improper integrals, beta function and gamma functions.

MATH 103 Differential Equations: 3 credits, 3hours/week.

Introduction to differential equation, First order differential equations, separable equations; Bernoulli's equations; initial value problems; boundary value problems; linear equations and exact equations; fundamental solutions of homogeneous equations;

Linear second order equations, linear differential operators, homogeneous linear equations with constant coefficients, method of undetermined coefficients and variable parameters. Theory of higher-order linear differential equations,

Laplace transforms, inverse Laplace transform, solving initial problems, convolution, impulses and Dirac delta functions; Partial differential equations, wave equations, particular solutions with boundary and initial conditions.

MATH 105 Coordinate Geometry and Vector Analysis: 3 credits 3 hours/week

Two-dimensional co-ordinate geometry: straight line, circle, parabola, ellipse; Three-dimensional co-ordinate geometry: systems of co-ordinates, distance between two points, section formula, direction cosines, projection;

Plane; line; Vector analysis: definition, equality, addition and multiplication of vectors; examples.

Differentiation and integration of vectors with applications. Definitions of line, surface and volume integrals. Gradient, divergence and curl, their integral and differential forms. Divergence theorem, Green's theorem, Stoke's theorem.

MATH 201 Linear Algebra: 3 Credits, 3 hours/week

Matrix algebra and solutions of systems of linear equations, Gaussian elimination, matrix operations, properties of systems and matrices, determinants.

Vector spaces, linear dependence and independence of vectors; span, basis and dimension, subspaces. Fourier series, Legendre and Bessel equations and polynomials;

Inner products, Gram-Schmidt process. Linear transformations, eigenvalues and eigenvectors, the spectral theorem, generalized eigenvalues and eigenspaces, Jordan canonical form. Applications

MATH 203 Probability and Statistics: 3 Credits, 3 hours/week

Statistics: Frequency distribution. Mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion.

Moments, skewness and kurtosis; Correlation and regression analysis; Elementary probability theory and discontinuous probability distribution, e.g. binomial, poisson and negative binomial.

Continuous probability distributions, e.g. normal and exponential. Characteristics of distributions. Elementary sampling theory. Estimation. Hypothesis testing.

BASIC SCIENCES

PHY 101 Physics I: 3.0 Credits, 3 hours/week

Physical Optics: theories of light: Huygen's principle and construction. Interference of light: Young's double slit experiment, Fresnel bi-prism, Newton's rings, interferometers. Diffraction of light: Fresnel and Fraunhofer diffraction, diffraction by single slit, diffraction by double slit, diffraction gratings, polarization, production and analysis of polarized light, optical activity, optics of crystals.

Heat and Thermodynamics: Temperature, zeroth law of thermodynamics. Thermometers: constant volume, platinum resistance, thermocouple. First law of thermodynamics and its application, molar specific heats of gases, isothermal and adiabatic relations, work done by a gas. Kinetic theory of gases: explanation of gas laws, kinetic interpretation of temperature, equipartition of energy and calculation of ratio of specific heats, mean free path, Vander Waals equation of state, second law of thermodynamics: reversible and irreversible processes, Carnot cycle, efficiency, Carnot's theorem, entropy.

Waves and Oscillations, oscillations: Simple harmonic motion, damped simple harmonic oscillations, forced oscillations, resonance, vibrations of membranes and columns. Combination and composition of simple harmonic motions, Lissajous' figures. Transverse and longitudinal nature of waves, travelling and standing waves, intensity of a wave, energy calculation of progressive and stationary waves, phase velocity, group velocity. Sound waves: velocity of longitudinal wave in a gaseous medium. Doppler effect, architectural acoustics: Sabine's formula, requisites of a good auditorium.

PHY 104 Physics Laboratory: 1.0 credit, 3 hours/week

Determination of the specific heat of a liquid by the method of cooling. Determination of the thermal conductivity of a bad conductor by Lee's method. Determination of the pressure coefficient of air by constant volume air thermometer. Determination of the frequency of a tuning fork by Melde's apparatus. Determination of the focal length of concave lens by auxiliary lens method. Measurement of unknown resistance and verification of the laws of resistance by P.O. (Post Office) box. Comparison of the E.M.F's of two cells by potentiometer. Determination of the mechanical equivalent of heat by electrical method. Determination of the radius of curvature of a plano-convex lens by Newton's ring method. Determination of threshold frequency for the photoelectric effect of a photocathode and the value of the

Planck's constant. To plot thermo-electromotive force-temperature (calibration) curve for a given thermocouple. Determination of the melting point of a solid using the calibration curve. Determination of the specific rotation of sugar solution by a polarimeter. Determination of the temperature co-efficient of the resistance of the material of a wire. Determination of the refractive index of the material of a prism using spectrometer. Determination of the spring constant and the effective mass of a loaded spring.

PHY 103 Physics II: 3.0 Credits, 3 hours/week

Structure Matter: States of matter: solid, liquid and gas. Classification of solids: amorphous, crystalline, ceramics and polymers. Atomic arrangement in solids. Different types of bonds in solids: metallic, Vander Waals, covalent and ionic bond, packing in solids, interatomic distances and forces of equilibrium, x-ray diffraction; Bragg's law. Plasticity and elasticity. Distinction between metal, insulator and semi-conductor.

Electricity and Magnetism: Electric charge, Coulomb's law. the electric field: calculation of the electric field strength, E ; a dipole in an electric field, electric flux and Gauss's law, some application of Gauss's law; electric potential V , relation between E and V , electric potential energy. Capacitors; capacitance, dielectrics: an atomic view, dielectrics and Gauss's law; current and resistance: current and current density. Ohm's law, resistivity: an atomic view, Ampere's law, Faraday's law, Lenz's law, self inductance and mutual inductance. Magnetic properties of matter: magnetomotive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, magnetisation curves.

Modern Physics. Michelson Morley's experiment, Galilean transformation, special theory of relativity, Lorentz-transformation, relative velocity, length contraction, time dilation, mass-energy relation. Photo-electric effect, Compton effect, de-Broglie wave, Bohr's atom model. Radioactive decay, half life, mean life, isotopes, nuclear binding energy, alpha, beta, gamma decay.

CHEM 101 Chemistry I: 3.0 Credits, 3 hours/week

Atomic structure, Atomic models, properties of different subatomic particles, Electron configurations; periodic table.

Chemical bonds; Different types of solutions, Concentration units.

Physical and chemical properties of water, Chemical equilibrium and thermo chemistry. Chemistry of cement, silicates and limes.

CHEM 102 Chemistry Laboratory: 1.0 Credit, 3hours/week

Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu and Ca volumetrically.

CHEM 103 Chemistry II: 3.0 Credits, 3 hours/week

Reactions kinetics: rate of chemical reactions; order and molecularity of reactions, different types of rate expressions, methods of determining rate and order, effect of temperature on reaction rate and energy of activation.

Colloid and colloidal solution: classification, preparation, purification, properties, protective action and application of colloids.

Chemical corrosion: introduction to chemical corrosion, corrosion of metals and alloys in dry and wet environments, mechanism of corrosion, atmospheric and soil corrosion and their protective measures.

Chemistry of environmental pollution: environment and its characteristics, chemistry of toxic metal and non-metal pollutants, analytical techniques used in the determination of pollutants, chemical concept of DO, BOD, COD and threshold odor number, chemistry involved in water treatment plants, quality of industrial waste water.

Polymers: chemistry of polymerization, different types of polymers and their properties, polymer degradation, elastomers and composite materials.

Paints and varnishes: introduction to paints and varnishes, pretreatment of the surface, metallic, non-metallic and organic protective coating, types of paints and their uses.

HUMANITIES

ENG 101: English Reading and Composition: 3 Credit, 3 hours/week

Vocabulary; English grammar: Capitalization, articles, Tense, construction of sentences, use of prepositions.

Analytic reading (Skimming, and scanning), fluency and control of writing process (organization, paragraphing, coherence and cohesion); development of expressive, persuasive and referential writing.

Employing appropriate formal speech. Precise writing; Technical Project work.

BUS 201: Business Communications: 3 Credits, 3 hours/week

Commercial correspondence. Communication skills: Reading, Writing, Listening, and Speaking skills; Written communication: letters, memos and formal reports;

Oral communication; Use of visual aids in communication; Use of Non-verbal communication; Effective Business Meeting;

Public notice and advertisements. Legal notice.

ECO 101: Economics: 3 Credits, 3 hours/week

Definition of Economics. Economics and Engineering. Principles of Economics; Micro economics: The theory of demand and supply and their elasticities. Price determination.

Nature of an economic theory, applicability of economic theories to the problems of developing countries. Indifference curve technique. Marginal analysis. Optimization. Market. Production, Production function, types of productivity. Rational region of production of an engineering firm. The Short run and the Long run. Fixed cost and variable cost. Internal and external economics and diseconomies.

Macro - economics: Savings, investment. National income analysis. Inflation. Monetary policy, Fiscal policy and Trade policy with reference to Bangladesh. Planning in Bangladesh.

SOC 101: Sociology: 3 Credits, 3 hours/week

Scope, some Basic Concepts. Social evolution and techniques of production, culture and civilization. Social structure of Bangladesh. Population and world resources. Oriental and Occidental societies, Industrial revolution. Family urbanization and industrialization, Urban Ecology, Co-operative and Socialist movements. Rural Sociology.

Some basic concepts of government and Politics. Functions, organs and forms of modern state and Government; socialism. Fascism, Marxism, U.N.O.

Government and politics of Bangladesh. Some major administrative systems of developed countries. Local self-government.

ACT 201: Accounting: 3 Credits, 3 hours/week

Principles of accounting: accounts, transactions, the accounting procedures and financial statements.

Cost in general: objectives and classifications. Overhead costing. Cost sheet under job costing operating costing and process costing.

Marginal costing: tools and techniques, cost-volume-profit analysis. Relevant costing: analyzing the profitability within the firm, guidelines for decision making. Long-run planning and control: capital budgeting.

CIVIL ENGINEERING TOOLS

CE 111: Introduction to Civil Engineering: 3 Credits, 3 hours/week

Definition and history of Civil Engineering. Specializations in civil engineering: structural, geotechnical, transportation, water resources, environmental; Description of some outstanding civil engineering projects. Scope and nature of jobs of a civil engineer. Engineering ethics.

Foundations; different types of foundations; brick masonry; framed structures and bearing walls; arches and lintels;

Details of floors and roofs; pointing; plastering and interior finishing; scaffolding, staging; shoring and underpinning; thermal insulation and acoustics; House plumbing.

CE 113: Civil Engineering Drawing And CAD: 3 Credit, 3 hours/week

Introduction - lettering, numbering and heading; plane geometry-pentagon, hexagon, octagon, ellipse, parabola, hyperbola. Projection (Solid Geometry) - cube, triangular prism, square prism, pentagonal prism, hexagonal prism, cone, cylinder. Development - cube, pyramid, cone, prism; section and true shape - cube, pyramid, cone, prism. Isometric Drawing - cube, pyramid, cone. Oblique Drawing - cube, pyramid, cone, Interpretation of Solids.

Plan, elevation and section of one storied buildings. Plan, elevation and sections of multi-storied buildings; Plan and section of septic tank; plan, elevation and sections of culverts, bridges and other hydraulic structures; Building services drawings.

Introduction to computer aided drafting.

CE 115: Surveying: 3 Credits, 3 hours/week

Reconnaissance survey; linear measurements; traverse survey; leveling and contouring;

Calculation of areas and volumes; problems on heights and distances; curves and curve ranging, transition curve, vertical curves. Tachometry: introduction, principles and problems on tachometry.

Astronomical surveying: definition, instruments, astronomical corrections, systems of time. Photogrammetry: introduction of terrestrial photography, reading of photo mosaic, scale; project surveying; errors in surveying;

CE 116: Practical Surveying: 1 Credit, 3 weeks

3 weeks of field work based on CE 115.

CE 211: Computer Programming and Numerical Techniques: 3 Credits, 3 hours/week

Basic components of computer system; FORTRAN/C++ language; environment; input/output; data type; variable declaration; statement control; object oriented programming.

Numerical solution of algebraic and transcendental equations; matrices; solution of systems of linear equations;

Curve-fitting by least squares; finite differences; divided differences; interpolation;

Numerical differentiation and integration; numerical solution of differential equations; Computer applications to Civil Engineering problems.

CE 214: Quantity Survey: 1 Credit, 3 hours/week

Analysis of rates; detailed estimate of all items of work of a building, bridge, truss, highway. Specifications of materials for the above constructions.

CE 215: Introduction to GIS: 3 Credits, 3 hours/week

Introduction to remote sensing; image interpretation, introduction to global positioning system (GPS).

Processing and analysis using raster based GIS software; introduction to GIS and the state of GIS in civil engineering research and problem solving; application of GIS;

Introduction to cartography and maps; instrumentation and training on data acquisition, processing, manipulation, analysis and product generation using vector based GIS software. Aerial photography.

CE 216: GIS Lab.: 1 Credit, 3 hours/week

Training on data acquisition, processing, manipulation, analysis and product generation using vector based GIS software; Project Class on application of GIS in Civil Engineering.

ENGINEERING SCIENCES

CE 221: Engineering Geology and Geomorphology: 3 Credits, 3 hours/week

Mineralogy & Petrology: Definition. Common rock forming mineralogy (Physical properties & diagnostic characters), clay minerals.

Definition of rock, rock types. Wenworth grade scale, common major rock types of Bangladesh and their physical characteristics. Structural Geology: General, common types of geological structures in Fold, Faults, unconformity, joints, cleavages- description, types and identification.

Stratigraphy & Tectonics: Tectonics of Bangladesh, surface and subsurface geology of Bangladesh. Earthquake and seismic map of Bangladesh. Geomorphology: Physical process of the earth, configuration, erosional and depositional features, weathering and erosion. River morphology (channel development, channel patterns, river types and stream patterns). Landforms of Bangladesh.

CE 223: Engineering Materials: 3 Credit, 3 hours/week

Atomic structure and bonding; crystal structures, mechanical properties of engineering materials, yielding, fracture, elasticity, plasticity; properties and uses of rubber, timber and plastics.

Properties and uses of bricks, efflorescence; standard tests of bricks; brick masonry; cement, cement chemistry, aggregates; coarse aggregates and fine aggregates, cement and lime mortars,

Concrete, Design of concrete mixes, salinity problem in concrete, corrosion and its prevention, Ferro cement. paints, varnishes, metallic coating.

CE 224: Engineering Materials Testing Lab.: 1 Credit, 3 hours/week

General discussion on preparation and properties of concrete. Test for specific gravity. Unit weight, voids and bulking of aggregates; moisture content and absorption of coarse and fine aggregates; normal consistency and initial setting time of cement; direct tensile and compressive strengths of cement mortar; gradation of coarse and fine aggregates; design and testing of a concrete mix.

CE 225: Fluid Mechanics: 3 Credits, 3 hours/week

Development and scope of fluid mechanics. Fluid properties. Fluid statics. Kinematics of fluid flow. Fluid flow concepts and basic equations- continuity equation, Bernoulli's equation,

energy equation, momentum equation and forces in fluid flow. Similitude and dimensional analysis. Steady incompressible flow in pressure conduits, laminar and turbulent flow, general equation for fluid friction.

Empirical equations for pipe flow. Minor losses in pipe flow. Fluid measurement: Pitot tube, orifice, mouthpiece, nozzle, venturimeter, weir. Pipe flow problems -pipes in series and parallel, branching pipes, pipe networks.

CE 226: Fluid Mechanics Lab.: 1 Credit, 3 hours/week

Centre of pressure. Proof of Bernoulli's theorem. Flow through Venturimeter. Flow through orifice. Coefficient of velocity by coordinate method. Flow through mouthpiece. Flow over V-notch. Flow over sharp- crested weir. Fluid friction in pipe.

ENV210: Environmental Science: 3 Credits, 3 hours/week

Man and environment. Major components of the environment. Brief history of earth, bio-geo-chemical cycles. Population and the environment; basic population dynamics. Biosphere:

Ecological concepts and ecosystems; flow of matter and energy through an ecosystem; biodiversity. Lithosphere: agriculture and environment; urbanization; solid and hazardous waste management.

Atmosphere: chemistry of air; urban air pollution, acid rain; global warming; ozone layer depletion. Hydrosphere: water chemistry; water pollution and prevention; wetland and coastal management. Alternative energy sources. Environmental health and toxicology. Sustainable development.

CE 321: Hydrology: 3 Credits, 3 hours/week

Hydrologic cycle. Weather and Hydrology. Precipitation, Evaporation and transpiration.

Infiltration. Stream flow. Rainfall-runoff relations. Analysis of hydrologic data.

Hydrographs, unit hydrographs. Hydrologic routing, Drainage and flood routing. Statistical methods in hydrology.

ENGINEERING BASIC AND CORE COURSES

CE 131: Engineering Mechanics: 3 Credits, 3 hours/week

Units; Introduction to SI Units; Resultants and Components; coplanar concurrent forces; Truss – Joint to Joint method, moments and parallel coplanar forces;

Non-concurrent non-parallel coplanar forces; Trusses and Frames; Friction; flexible cords;

Centroids; moment of inertia of areas; moment of inertia of masses. plane motion; force systems that produce rectilinear motion, work, kinetic energy; power, impulse and momentum.

CE 231: Mechanics of Solids: 3 Credits, 3 hours/week

Fundamental concepts of stress and strain. Mechanical properties of materials; strain energy; stresses and deformations in members subjected to axial forces, shear and temperature changes;

Bending moment and shear force diagrams of beams; flexural stresses in beams, shearing stresses in beams; shear centre;

Transformation of stresses; Mohr's circle of stress; Buckling of Columns; Torsional stresses in shafts and tubes Thin walled pressure containers; riveted and welded joints. Compound stresses; helical springs;

CE 232: Structural Mechanics and Materials Testing Lab.: 1 Credit, 3 hours/week.

Tension, direct shear and impact tests of mild steel specimen, compression test of timber specimen, slender column test; static bending test; hardness test of metals; helical spring tests; determination of shear centre; load-deflection behavior of simple beam.

CE 331: Reinforced Concrete Fundamentals: 3 Credits, 3 hours/week

Introduction to Reinforced concrete, RC Structures; Loads and specifications; Design Codes; Materials in reinforced concrete, Fundamental behavior of reinforced concrete; introduction to WSD and USD methods;

Analysis and design of singly reinforced, doubly reinforced and T-beams according to WSD and USD methods;

Shear and Diagonal tension, Code specifications; bond, anchorage and development length according to USD method; Serviceability, crack and deflection control; analysis and design for torsion.

CE 333: Design of Reinforced Concrete Structures: 3 Credit, 3 hours/week

One way slabs, Design of two way slabs; Design of flat plates;

Design of Columns; Design of Footings and mats;

Retaining walls; reinforced concrete floor and roof systems. Design of reinforcements at joints; Review of codes; yield line method; introduction of pre-stressed concrete.

CE 334: Reinforced Concrete Design Session: 1 Credit, 3 hours/week

Reinforcement details of beams, slabs, stairs. Analysis and design of various elements of a slab bridge, simple girder bridge, a low-rise building, water tower, rigid frame bridge, folded plate roof.

CE 335: Structural Analysis and Design-I: 3 Credits, 3 hours/week

Analysis of statically determinate trusses and arches; Deflection of beams by direct integration, moment area, elastic load and conjugate beam methods.

Influence lines; moving loads on beams, frames and trusses;

Cables and cable supported structures. Deflection of beams, trusses and frames by virtual work method; Wind and earthquake loads; Code equations.

CE 337: Building Services: 3 Credits, 3 hours/week

Introduction to plumbing, water requirements in a building, water sources; water supply and distribution in buildings; plumbing of multistoried buildings.

Building sewer and drainage system, sewage disposal; hydraulics of sewer; design, construction and maintenance of sanitary sewer and storm drainage system; sewer appurtenances.

House wiring; air conditioning; lift installation; air handling unit, and other electrical and mechanical installations in building.

CE 431: Structural Analysis and Design-II: 3 Credit, 3 hours/week

Stability and determinacy of structures; Approximate analysis of statically indeterminate structures, e.g. braced trusses, portal frames, mill bent and multi storied building frames;

Analysis of statically indeterminate structures by consistent deformation. flexibility method; stiffness method;

moment distribution method; slope-deflection methods of analysis.

CE 432: Structural Analysis and Design Sessional: 1 Credit, 3 hours/week

Analysis and design problems; design of members and connection of steel structures; e.g. trusses and plate girders. Detailed drawing of roof-truss,

Welding, types of weld, design of weld; Folded plate, analysis and design; steel bridges, arch, suspension, cable stayed bridge.

CE 341: Principles of Geotechnical Engineering: 3 Credits, 3 hours/week

Introduction to geotechnical engineering; formation, type and identification of soils; soil composition; soil structure and fabric; index properties of soils; engineering classification of soils;

Soil compaction; principles of total and effective stresses; permeability and seepage; stress-strain-strength characteristics of soils;

compressibility and settlement behavior of soils; lateral earth pressure; stress distribution.

CE 342: Geotechnical Engineering Lab.: 1 Credit, 3 hours/week

Field identification tests; grain size analysis by sieve and hydrometer; specific gravity test;

Atterberg limits test; permeability tests; unconfined compression test; compaction test; relative density test; direct shear tests; consolidation tests.

CE 343: Foundation Design and Construction: 3 Credit, 3 hours/week

Soil investigation techniques; types of foundations; Bearing capacity shallow and deep foundations; Settlements calculations;

Design and construction of footings, rafts and piles in clay;

Design and construction of footings, rafts and piles in sand; slope stability analyses;

CE 351: Transportation and Traffic Engineering: 3 Credit, 3 hours/week

Introduction to transportation engineering; development of transportation systems; elements of transportation system; transportation in Bangladesh; Traffic Engineering: the road/traffic system, vehicle and traffic characteristics, transportation planning concepts: collection, study and analysis of basic data, volume study, speed study.

Traffic control devices: road sign, road marking, traffic signal, traffic, parking study and roadway lighting; terminals, Railways: general requirements: rail, sleeper, ballast

Railway: Track fittings, track alignment, tractive power, station and yards, signaling, track maintenance.

CE 353: Highway Materials and Geometric Design: 3 Credit, 3 hours/week

Highway materials; sub grade, sub base and base courses; aggregate properties and tests, Bitumen: properties and uses of bituminous materials, pavement layers and functions, road intersections.

Mix design methods for flexible and rigid pavements, construction and maintenance of flexible and rigid road pavements; various stresses and distresses of pavement, equipments.

Geometric design of highways: elements of design, cross-section elements, curves and sight distances; soil stabilization and soil aggregates in road constructions; low-cost roads;

CE 354: Highway Materials and Traffic Engineering Lab.: 1 Credit, 3 hours/week

Tests on subgrade, subbase and base materials: aggregate strength test, tests on aggregate shape; Roadway capacity studies.

Tests on bituminous materials: specific gravity, penetration test, softening point and flash & fire point test, Marshal method of mix design, CBR test

CE 361: Water Supply Engineering: 3 Credits, 3 hours/week

Water Supply Engineering: introduction; water demands; water supply sources; ground water exploration: aquifer properties and ground water flow, well hydraulics, water well design, drilling, construction and maintenance; water demand for rural communities; shallow hand tube wells and deep set Tara pumps for problem areas.

Surface water collection and transportation; head works; pumps and pumping machineries; water distribution system; analysis and design of distribution network; fire hydrants; water meters; leak detection; unaccounted for water.

Water quality requirements; water treatment - plain sedimentation, flocculation and settlement, filtration, disinfection; miscellaneous treatment methods; low cost treatment methods for rural communities.

CE 362: Water & Wastewater Quality Lab.: 1 Credit, 3 hours/week

Physical, chemical and bacteriological tests of water and wastewater; design of water supply system.

CE 363: Waste Water and Sanitary Engineering: 3 Credits, 3 hours/week

Wastewater Engineering: introduction; water supply, sanitation and health; estimation of wastewater; wastewater collection systems; Sanitation for low income communities - on-site sanitation systems for rural communities; design and construction of septic tanks, soak wells and subsurface drain fields; rural sanitation in Bangladesh

Microbiology of sewage and waste water; Wastewater characteristics; preparatory, primary treatment methods and disposal; low cost small bore sewerage for small townships.

Secondary treatment methods and disposal treatment and disposal of industrial effluents; sludge treatment and disposal; Sustainability of water and sanitation services; participatory development approach in water and sanitation sector; community management of water and sanitation services.

CE 371: Open Channel Hydraulics: 3 Credits, 3 hours/week

Open channel flow and its classification. Velocity and pressure distributions. Energy equation, specific energy and transition problems.

Critical flow and control. Principles of flow measurement and devices . Concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow.

Momentum equation and specific momentum. Hydraulic jump. Theory and analysis of gradually varied flow. Computation of flow profiles. Design of channels.

CE 372: Open Channel Hydraulics Lab.: 1 Credit, 3 hours/week

Broad-crested weir. Sluice gate. Venturi flume. Parshall flume. Cut-throat flume. Hydraulic jump. Velocity distribution profile. Manning's roughness coefficient. Specific force and specific energy.

CE 471: Irrigation and Flood Control and Drainage: 3 Credit, 3 hours/week.

Importance of irrigation. Sources and quality of irrigation water. Soil- water relationship. Consumptive use and estimation of irrigation water requirements. Methods of irrigation.

Design of irrigation canal system. Irrigation structures. Irrigation pumps. Problems of irrigated land. Flood and its control. Soil-water relationship: soil properties, use of tensiometer, infiltration rate.

Losses in irrigation system. Irrigation requirement and scheduling. Design of irrigation and drainage canal network. Pumps in series and parallel. Pump characteristics. Flow through canal regulating structures.

CE 499: Special Topics: Credit, 3 hours/week

To expose the students to the state – of – the – art development in the field of science and engineering special courses will be offered.

ENGINEERING DESIGN/THESIS

CE 492: Capstone design: 2 credit, 6 hours/week

Group projects for senior students to work in teams to design civil engineering systems. Application of standard analysis and design softwares. Understanding of multidisciplinary systems, interaction between design and construction professionals, realistic design constraints, professional practice issues including importance of professional licensure and continuing education, procurement of work, bidding vs quality based selection processes, engineering professionalism and ethics. The course spreads over two terms and requires oral presentation and written report in each term.

CE 494: Project and Thesis: 2 Credit, 6 hours/week

Experimental and theoretical investigation of various topics in structural engineering, concrete technology, environmental engineering, transportation engineering, geotechnical engineering and water resources engineering. Individual or group study of one or more topics from any of the above fields. The students will be required to submit thesis/project report and make oral presentation at the end of the work.

ELECTIVE COURSES

(Students to select Five subjects from any two groups and at least two courses from each of those two groups)

Environmental Engineering

CE 461 : Environmental Chemistry: 3 credit, 3 hours/week

Introductory discussion on environmentally active organic and inorganic compounds and their structure, function, formation, transport, transformation and distribution. Aquatic environmental chemistry: chemistry of water pollution and treatment, analytical techniques for water samples; atmospheric chemistry: air pollution & treatment, analytical techniques for air samples; soil chemistry: soil contamination & waste disposal issues, analytical techniques for soil samples; environmental toxicology.

Pre-requisite: CHEM 101.

CE 463 : Solid and Hazardous Waste Engineering: 3 credit, 3 hours/week

Solid Waste Management: sources and types of solid wastes; physical and chemical properties of solid wastes; solid wastes generation; on-site handling, storage and processing; collection of solid wastes; transfer stations and transport; ultimate disposal methods; resources and energy recovery; soil pollution.

Industrial solid waste collection and disposal; hazardous waste management.

CE 465 : Environmental Management: 3 credit, 3 hours/week

Environment and Development Projects: environment and sustainable development;

Environmental policies and legislation; environmental implication of sectoral development;

environmental quality standards; environmental issues and priorities; environmental impact assessment of development schemes - baseline studies, assessment methodologies; economics of environmental management; special topics.

CE 467: Environmental Pollution Control: 3 credit, 3 hours/week

Environment Pollution and Its Control: water pollution - sources and types of pollutants; waste assimilation capacity of streams; dissolved oxygen modeling; ecological balance of streams; industrial pollution; heavy metal contamination; detergent pollution and eutrophication; ground-water pollution ; marine pollution; pollution control measures - water quality monitoring and management.

Air pollution - sources and types of pollutants; effects of various pollutants on human health, materials and plants; air pollution meteorology; global warming and greenhouse effects; air pollution monitoring and control measures.

CE 469: Environmental Impact Assessment: 3 Credits, 3 hours/week

Concept of environmental impact assessment; project cycle, scoping, initial environmental examination (IEE) and environmental impact assessment (EIA); method of impact identification - matrix, network and checklist methods, modeling and simulation; environmental indices and indicators for air, water, land and biota; and assessment of impacts on different environmental media; assessment of visual impacts, social impacts and cultural impacts; decision method for evaluation of alternatives - weighting, scaling, rating and ranking of alternatives, decision matrix; peoples participation; migration measures; environmental monitoring; preparation of TOR for an EIA, EIA Report.

Geotechnical Engineering

CE 441: Earth Retaining Structures: 3 credit, 3 hours/week

Foundation for structures subjected to lateral loads; retaining walls and abutments; operation and methods of construction, dewatering and slurry-wall construction.

Flexible earth retaining structures, sheet piles, cofferdams, shore-piles, soldier piles, braced excavations, caissons.

CE 443: Soil Mechanics Theories and Applications: 3 credit, 3 hours/week

Introduction to critical state soil mechanics, SHANSEP and stress path methods; Stress deformation and failure of soil masses. One, two and three dimensional consolidation problems; pore pressure coefficients; soil structure-interaction; earthquake and liquefaction problems; soil improvement; numerical solution of geotechnical engineering problems.

CE 445: Soil Water Interaction Problems: 3 credit, 3 hours/week

Introduction to soil-water interaction problems. Permeability, capillarity and soil suction. Seepage analysis, stability of natural, man made slopes and excavations subjected to seepage, water current, wave action etc. Theories of filters and revetment design; hydraulic fills.

Structural Engineering

CE 433: Finite Element Methods: 3 credit, 3 hours/week

Introduction to finite element method as applied to Civil Engineering problems. One dimensional stress deformation and time dependent flow problem. Two dimensional plane stress and plane strain analysis of stress deformation problems.

CE 435 : Dynamics of Structures: 3 credit, 3 hours/week

Formulation of equation of motion; free vibration response; SDOF and MDOF systems; response to harmonic and impulse loading and vibration analysis by Rayleigh's method. Dynamics of multi degree of freedom systems. Evaluation repair and retrofitting of existing structures.

CE 437: Design of Steel Structures: 3 credit, 3 hours/week

Behavior of structural steel members and steel frames; code requirements; design of tension and compression members by ASD and LRFD methods; design of beams, beam-columns; Joint design.

CE 439 : Prestressed Concrete Structures: 3 credit, 3 hours/week

Prestressed concretes: materials; prestressing systems; loss of prestress; analysis of sections for flexure, shear, bond and bearing; beam deflections and cable layout; partial prestress.

Design of prestressed sections for flexure, shear, bond and bearing.

Transportation Engineering

CE 451: Transportation Planning & Economics: 3 credit, 3 hours/week

The transportation planning process; Highway needs study; highway planning, economics and financing; evaluation and analysis of transportation projects. Management, monitoring;

Organization and implementation of transportation projects; selected case studies.

CE 453: Traffic Engineering and Management: 3 credit, 3 hours/week

Traffic management concepts; traffic accident investigations; city road and street networks:

grade separation and interchanges, pedestrian and bicycle facilities. The urban bypass;

environmental aspects of highway traffic and transportation projects; elements of traffic flow. Traffic engineering administration and legislation; urban public transportation and freight movement.

CE 453: Highway Drainage & Airports: 3 credit, 3 hours/week

Highways drainage and drainage structures. Evaluation and strengthening of pavements;

importance, advantages and trends in air transportation; planning and design of airports; aircraft characteristics related to airport design; types and elements of airport planning studies; airport configuration; geometric design of the landing area; Terminal area; heliports; design of airport pavements; lighting, marking and signing; Airport drainage.

Water Resources Engineering

CE 473: Coastal and Estuarine Systems: 2 Credit, 2 hours/week

Coast and coastal features. Tides and currents. Tidal flow measurement. Waves and storm surges. Docks and harbours. Forces of waves and tides in the design of coastal and harbour structures. Coastal sedimentation processes. Deltas and estuaries. Shore protection works. Dredging and dredgers.

CE 475: River Engineering: 3 Credit, 3 hours/week

Behaviour of alluvial rivers. River channel pattern and fluvial processes. Aggradation and degradation, local scours, river training and bank protection works. Navigation and dredging Sediment movement in river channels, bed forms and flow regimes.

CE 477: Design of Hydraulic Structures: 3 Credit, 3 hours/week

Principles of design of hydraulic structures, types of hydraulic structures. Design of dams, barrages, weirs, spillways, energy dissipaters and spillway gates. Cross drainage work.