Chapter 5

Detail Outline of Undergraduate Courses

5.1 Courses Offered by the Department of Civil Engineering (For Civil Engineering students)

CE 100: Civil Engineering Drawing
1.50 credits, 3 hrs/week

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

CE 101: Analytic Mechanics
3.00 credits, 3 hrs/week

Coplanar and non-coplanar force systems; moments; analyses of two-dimensional frames and trusses; friction; flexible chords; centroids of lines, areas and volumes; moments of inertia of areas and masses; plane motion; principles of work and energy; impulse and momentum; virtual work principle for rigid bodies.

CE 102: Computer Aided Drafting
1.50 Credits, 3 hrs/week

Introduction to computer usage; introduction to CAD packages and computer aided drafting: drawing editing and dimensioning of simple objects; plan, elevations and sections of multi-storied buildings; reinforcement details of beams, slabs, stairs etc; plan and section of septic tank; detailed drawings of roof trusses; plans, elevations and sections of culverts, bridges and other hydraulic structures; drawings of building services.

CE 103: Surveying
3.00 credits, 3 hrs/week

Reconnaissance survey; linear measurements; traverse survey; triangulation, datum, leveling and contouring; calculation of areas and volumes; problems on heights and distances; curves and curve ranging, transition curve, vertical curves; total station and real time kinematic (RTK): introduction, principles and techniques; aerial photography; remote sensing; mapping; introduction to geographic information system (GIS), coordinate system and global positioning system (GPS); Introduction to UAV (drone), LiDAR, GPR (Ground penetrating radar) based survey techniques; Hydrographic Surveying.

CE 104: Practical Surveying
1.50 credits, 3 hrs/week

Linear and angular measurement techniques; traverse surveying; leveling and contouring; curve setting; project surveying; modern surveying equipment including Introduction to UAV (drone), LiDAR and their applications; processing of survey data in AutoDesk Civil 3D software viz. generation of contour, topographic survey map.

CE 200: Details of Constructions
1.50 credits, 3 hrs/week

Types of building, components of a building, design loads, framed structure and load bearing wall structure; foundations: shallow foundation and deep foundation, site exploration, bearing capacity of soil, standard penetration test; brick masonry: types of brick, bonds in brickwork, supervision of brickwork, brick laying tools, defects and strength on brick masonry, typical structures in brickwork, load bearing and non-load bearing walls, cavity walls, partition walls; lintels and arches: different types of lintels and arches, loading on lintels, construction of arches; stairs: different types of stairs, floors: ground floors and upper floors; roofs and roof coverings; shoring; underpinning; scaffolding and formwork; plastering, pointing, painting; distempering and white washing; cement concrete construction; sound insulation: acoustics; thermal insulation; house plumbing: water supply and wastewater drainage.

CE 201: Engineering Materials
3.00 credits, 3 hrs/week

Mechanical behavior and properties of engineering materials: steel-steel products, making of steel, heat treatment, time dependent strain response and corrosion; cement: composition, manufacturing and types; bricks and blocks: manufacturing and classification based on national and international standards; aggregates: coarse & fine aggregates, types and gradation; admixtures; concrete: fresh and hardened states, mix design, durability, creep and shrinkage, non-destructive tests of concrete; mortar; lime; timber and wood products; plastics; ceramic tiles; glass; fiber reinforced polymer (FRP); ferrocement; introduction to green materials and recycled materials.

CE 202: Materials Sessional
1.50 credits, 3 hrs/week

Sampling and preparation of materials to determine different properties used in civil engineering construction; tests of cement: normal consistency, initial setting time, specific gravity, fineness, soundness and compressive strength; gradation of fine and coarse aggregates, tests of aggregates: specific gravity, density, water absorption, unit weight and voids; tests for tensile strength and compressive strength of concrete specimens; tests of bricks: water absorption, efflorescence and compressive strength; tests of blocks; Rebound hammer and Ultrasonic Pulse Velocity (UPV) tests on hardened concrete.

CE 203: Engineering Geology and Geomorphology
3.00 credits, 3 hrs/week

Minerals; identification of minerals, common rock forming minerals; physical properties of minerals; mineraloids rocks; types of rocks, cycle of rock change; earthquake and seismic map of Bangladesh.

Structural geology; faults; types of faults; fold and fold type; domes; basins; erosional process; quantitative analysis of erosional land forms. Channel development; channel widening; valley shape; stream terraces; alluvial flood plains; deltas and alluvial fans; channel morphology; channel patterns and the river basin; geology and geomorphology of Bangladesh.

CE 204: Computer Programming Sessional
1.50 credits, 3 hrs/week

Programming concepts and algorithms; internal representation of data; elements of structured programming language: data types, operators, expressions, control structures, functions, pointers and arrays, input and output; concept of Object Oriented Programming (OOP): encapsulation, inheritance, polymorphism and abstraction.

CE 205: Numerical Methods
2.00 credits, 2 hrs/week

Systems of linear algebraic equations; interpolation and curve fitting; roots of equations; numerical differentiation; numerical integration; initial value problems; two-point boundary value problems; finite differences.

CE 206: Engineering Computation Sessional
1.50 credits, 3 hrs/week
Prereq. CE 204

Introduction to hi-level computational programming tools; application to numerical analysis: basic matrix computation, solving systems of linear equations, non-linear equations, differential equations, interpolation and curve fitting, numerical differentiation, numerical integration; application to engineering problems: solving problems related to mechanics, numerical solution of equation of motion etc.

CE 207: Applied Mathematics for Engineers
3.00 credits, 3 hrs/week

Review of differential equations; power series solution of differential equations and their applications: Frobenius method, Legendre's polynomials, gamma function, Bessel's function; integral form of differential equation and its application to engineering problem solving.

Fourier series and its properties, application to engineering problem solving; Fourier integral; Fourier transforms and their uses in solving

boundary value problems.

Application of statistical methods to engineering problems: Random variables; discrete and continuous probability distributions; functions of random variables and derived distributions; expectation and moments of random variables; point estimation of distribution parameters: methods of moments and maximum likelihood, Bayesian analysis; confidence intervals; hypothesis tests; nonparametric statistical tests; simple and multiple linear regression and model selection; uncertainty and reliability analysis; project level decision making and quality control.

CE 208: Quantity Surveying
1.50 credits, 3 hrs/week

Earthwork excavation for roadway, earthwork computation from spot levels; estimation for residential building: estimation of slab, beam, column, footing; analysis of rates, specifications, costing of residential building; estimation and costing of septic tank; estimation and costing of underground water reservoir; estimation and costing of retaining wall; estimation and costing of slab culvert; estimation and costing of bridges; highways construction; estimation of steel truss; computer aided quantity estimation; construction site survey and estimation.

CE 210: Architectural, Engineering and Planning Appreciation
1.50 credits, 3 hrs/week

Introduction to different fields of Civil Engineering- Structural, Geotechnical, Transportation, Environmental and Water Resources Engineering; Appreciation of Architecture, Electro-Mechanical Engineering, Urban-Regional Planning and their interactions with Civil Engineering.

CE 211: Mechanics of Solids I
3.00 credits, 3 hrs/week
Prereq. CE 101

Concepts of stress and strain, generalized Hooke's law; deformations due to tension, compression and temperature change; frame statics: reactions, axial force, shear force and bending moments; axial force,

shear force and bending moment diagrams of beams using method of section and summation approach; elastic analysis of circular shafts in torsion, solid noncircular and thin walled tubular members subjected to torsion, flexural and shear stresses in beams; shear center; closely coiled helical springs.

CE 212: Structural Mechanics and Materials Sessional
1.50 credits, 3 hrs/week

Tension test of mild steel; bend and rebend test of deformed bar; direct shear test; impact tests of metal specimen; slender column test; static bending test; hardness test of metals; helical spring test; compression test of timber; coupon test of metal plates; tensile test of strand.

CE 213: Mechanics of Solids II
3.00 credits, 3 hrs/week
Prereq. CE 211

Symmetric and unsymmetrical bending of beams; stresses due to axial load and bending; stress transformation, Mohr's circle of stresses; beam deflection by direct integration and moment area method; elastic buckling of columns; elastic strain energy; cable theorem and cable supported structures, thin walled pressure vessels.

CE 300: Professional Training in Civil Engineering
1.00 Cr. Hr.

Involvement as a trainee in a Civil Engineering related industry/ projects/ firms to gather knowledge on state-of-the-art practices of Civil Engineering.

CE 301: Professional Practices and Communication
3.00 credits, 3 hrs/week

Project, its characteristic feature, project life cycle; PPP projects and risk matrix; type of contracts, introduction to FIDIC contracts; procurement regulations and law; documents for procurement of works, goods and services and their application; contract risk and contract responsibility; insurances; tender procedure; claims, disputes and arbitration procedure; measures for reducing fiduciary risks.

Introduction to communication concepts, modes of communication, methods of effective communication; writing various types of reports; utilizing graphics and visuals; oral presentation of reports; writing proposals; preparing effective business messages; conducting meetings; strategies for effective speaking and successful inter-personal communication; job application process, interviews and follow-ups; an introduction to the code of ethics for engineers.

CE 302: Professional Practices and Communication Sessional
1.50 credits, 3 hrs/week

Application of communication theory and professional practice approaches in a controlled classroom environment. This may include case study analysis – project inception, preliminary design, cost estimate and tendering process; role playing; preparing small reports and proposals; classroom presentations – oral and poster, individual reports submission etc.

CE 311: Structural Analysis
4.00 credits, 4 hrs/week
Prereq. CE 213

Stability and determinacy of structures; Analysis of statically determinate frames, trusses and arches; Influence lines; Moving loads on beams, frames and trusses; Wind and earthquake loads, code provisions.

Approximate analysis of statically indeterminate structures: Mill bents, braced trusses; Portal method, cantilever method and vertical load analysis of multi storied building frames; building drift.

Deflection of beams, trusses and frames by virtual work method; Approximate analysis of suspension bridges.

CE 315: Design of Concrete Structures I
3.00 credits, 3 hrs/week

Fundamental behavior of reinforced concrete and loads on structure; introduction to strength design and alternate design methods; flexural

design of beams (singly reinforced, doubly reinforced, T-beam) using strength design method; shear, diagonal tension and torsion of beams; bond and anchorage of reinforcement and its detailing; design of one-way slabs; design of two-way edge supported slabs.

CE 316: Bridge Design Sessional
1.50 credits, 3 hrs/week

Design and detailing of a slab bridge; design and detailing of a balanced cantilever bridge; design and detailing of a PC Girder Bridge.

CE 317: Design of Concrete Structures II
3.00 credits, 3 hrs/week
Prereq. CE 315

Design of column supported slabs; introduction to floor systems; structural forms; design of columns under uniaxial and biaxial loading, introduction to slender column; structural design of footings, pile caps; seismic detailing; shear wall subjected to axial load and flexure; introduction to prestressed concrete; analysis and preliminary design of prestressed beam.

CE 319: Design of Steel Structures
3.00 credits, 3 hrs/week

Behavioral principles and design of structural steel; design of tension members, residual stress; bolted and welded connections; compression members; local buckling, effective length; flexural members; lateral torsional buckling, flexure and shear strength, point loads on beam, design for deflection.

Introduction to beam-columns; non-sway frames.

Connection design: simple connection, moment connection, column bases; introduction to floor systems for steel buildings.

CE 320: Steel Structures Design Sessional
1.50 credits, 3 hrs/week

Analysis and design of low rise moment frame building for gravity and wind loads; design of members, connections and columns bases.

CE 331: Environmental Engineering I
3.00 credits, 3 hrs/week

Introduction to Environmental Engineering: ecology and environment; climate change; biodiversity; energy and environment.

Water Supply Engineering: introduction; water supply scenario in Bangladesh and SDG targets; 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 tubewells, deep tubewells, deep set pumps, rainwater harvesting, and alternative water supplies for problem areas.

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

Water quality requirements; water treatment: plain sedimentation, coagulation, flocculation, filtration, disinfection; miscellaneous treatment methods; low cost treatment methods for rural communities; water safety plans.

CE 332: Environmental Engineering Laboratory
1.50 credits, 3 hrs/week

Water and wastewater sampling techniques, sample preservation, physical, chemical and biological tests of water and wastewater; breakpoint chlorination, alum coagulation, sampling and laboratory analysis of air, sampling and laboratory analysis of soil and solid waste.

CE 333: Environmental Engineering II
4.00 credits, 4 hrs/week

Introduction to waste management: liquid waste, solid waste, air and noise pollution.

Wastewater Engineering: introduction; estimation of wastewater; wastewater collection systems; hydraulics of sewer; design,

construction and maintenance of sanitary sewer and storm drainage system; sewer appurtenances.

Wastewater characteristics; microbiology of wastewater; wastewater treatment and disposal; sludge treatment and disposal.

Sanitation and health; sanitation coverage in Bangladesh and SDG targets; onsite sanitation system including fecal sludge management (FSM), pour-flush toilets, septic tank system, Anaerobic Baffled Reactor (ABR); decentralized wastewater treatment systems (DEWATS).

Plumbing system.

Sustainability of water and sanitation services, introduction to EIA.

CE 341: Principles of Soil Mechanics
4.00 credits, 4 hrs/week
Prereq. CE203

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 Laboratory
1.50 credits, 3 hrs/week

Field identification tests of soils; 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; test of geotextiles.

CE 351: Transportation Engineering I: Transportation Planning and Traffic Engineering
3.00 credits, 3 hrs/week

Transportation engineering, transportation functions; transportation

systems, functional components, factors in transportation development, transportation modes, public transportation, emerging modes; intelligent transportation system: components and applications; transport planning: concepts, scope and hierarchy, process, goals and objectives, inventories, socio-economic activities, land use-transport interaction, travel demand forecasting; road safety and accident analysis.

Geometric design of highways: design controls and criteria, cross sectional elements, alignment, sight distance, intersection and interchange layouts, planning and design of bicycle and pedestrian facilities; traffic engineering: fundamentals of traffic engineering, vehicle and traffic characteristics, traffic control devices and systems, traffic studies, planning and design of parking facilities, roadway lighting; transportation in Bangladesh: transportation modes and networks, constraints and challenges, transport demand and modal share, road classification and design standards.

CE 400: Undergraduate Thesis
3.00 credits, 6 hrs/week

Experimental and theoretical investigation of various topics in structural engineering, environmental engineering, transportation engineering and geotechnical engineering. Individual or group study of one or more topics from any of the above fields. The students will be required to present and submit thesis at the end of the work.

CE 401: Project Planning and Construction Management
4.00 credits, 4 hrs/week

Project planning and control: planning and scheduling, bar charts, preparation of network diagram, PERT, CPM, LOB, resource leveling, linear programming in construction management.

Project evaluation: time value of money, economic decision making, annuities and perpetuities, cash flow diagrams, formulations for interest computation, evaluating alternatives by equivalence, effect of inflation on cash flow, benefit-cost ratio, risk and return in capital budgeting, capital asset pricing model and project cost of capital, financial and economic feasibility, sensitivity analysis.

Leading and managing teams: human resource management, dysfunctions in teams, team development, conflict management, leading teams, self-managing teams, decision making in teams, case study.

Project operation management: project management versus operation management, inventory management, economic order quantity, demand forecasting – newsvendor model, labor and plant management – line balancing, legal and ethical issues in project management, environmental regulations, procurement and value for money, project monitoring and control system.

Construction management: principles, project organization, methods and practices, technology, management of materials and equipment, site management, construction quality management – inspection, quality control and quality assurance, construction safety management.

CE 403: Sustainability of Development Projects
3.00 credits, 3 hrs/week

Concept of sustainable development; development and economic growth; sustainable development goals (SDGs); SDG indicators; economics and social structure; socio-economic indicators; human development index and human poverty index; poverty reduction strategies in Bangladesh; Bangladesh Delta Plan 2100 and Five-year Plan.

Socio-economic aspects of development projects; socio-economic assessment approach; socio-economic survey; human interest related aspects; land loss, land use and land ownership patterns; population displacement; resettlement and rehabilitation strategies; inequalities in distribution of benefits and losses; institutional and regulatory framework; land acquisition plan and resettlement action plan; community engagement in development projects; climate and disaster resilience of infrastructure; case studies.

CE 404: Capstone Project
4.50 credits, 9 hrs/week

Planning, analysis and design of an integrated civil engineering project with emphasis on structural engineering/ environmental engineering/ transportation engineering/ geotechnical engineering specialization. Students shall work in teams to apply civil engineering theories, methodologies, and skills to assess the technical, environmental, and social feasibility of the project including design and cost estimation. Student shall engage their diverse civil engineering and cross-disciplinary knowledge to prepare plans and specifications of the project including Bill of Quantity (BoQ) and tender documents.

Students shall present their projects and submit project reports at the end of the work.

CE 405: Business and Career Development
3.00 credits, 3 hrs/week

Understanding and managing organizations: structural, human resource, political, symbolic fames.

Developing strategy and competitive advantage: industry analysis, complementor, understanding value, strategy development.

Managing disruptive innovations - understanding innovation, organizing for innovation.

Marketing management: capturing market insight, connecting with customers, communicating value, building strong brands.

Career development: definition of career, value of career development, external and internal dimensions of career, career stages, preparing for job search, networking, interview, career fairs, internship, building online brand, preparing resume, civil engineering careers of the future and vision for civil engineering.

Becoming an entrepreneur: identify opportunity, developing business model, designing value Proposition, Lean Startups, Hypothesis

Testing, Sales & Marketing.

CE 407: Principles of Project Finance
3.00 credits, 3 hrs/week

Fundamental aspects of project finance, project development and management, working with lenders, project agreement, commercial risks, regulatory and political risks, financial structuring, financial model, financial support, documentation.

CE 410: Building Design Sessional
1.50 credits, 3 hrs/week

Analysis and design of low rise RC moment frame buildings for wind and low seismic application; multi-storied RC buildings with shear wall and mat foundation for wind and high seismic application; reinforcement design and detailing at joints.

CE 411: Analysis of Indeterminate Structures
3.00 credits, 3 hrs/week
Prereq. CE 311

Stiffness properties of beam elements; Moment distribution and flexibility/consistent deformation approaches in solving statically indeterminate structures e.g. beams, frames and trusses; matrix stiffness method in analyzing statically indeterminate beams, plane frames, grids and trusses subject to loads, temperature changes, support settlements etc.; computer application oriented direct stiffness method; influence lines of statically indeterminate structures.

CE 413: Introduction to Steel-Concrete Composite Structures
2.00 credits, 2 hrs/week

Introduction to composite structures, advantages of composite construction; behaviour of different types of composite columns, axial load capacity and interaction diagram for composite columns.

Composite floor system: details of composite deck and shear connectors.

Elastic and plastic analysis of composite beams; design of composite beams for serviceability and strength limit states.

CE 415: Prestressed Concrete
2.00 credits, 2 hrs/week

Prestressed Concrete: concepts of prestressing; materials; anchorage systems; loss of prestress; analysis of sections for flexure, shear, bond and bearing; analysis of end block and composite sections; beam deflections; cable layout; partial prestress.

Design of prestressed concrete beams for simple and continuous spans; ideas about use of AASHTO – PCI sections for standard spans; design considerations for prestressed concrete pipes, piles, poles and railway sleepers.

CE 417: Design of Concrete Structures III
2.00 credits, 2 hrs/week

Analysis and design for torsion; design of one way and two way joist slabs with or without beam on the column line; design and detailing of lateral load resisting components: shear wall, lift cores, diaphragm etc.; design of reinforcement at joints.

CE 419: Introduction to Finite Element Method
2.00 credits, 2 hrs/week

Introduction to finite element method as applied to stress analysis problems; basic equations in elasticity, matrix displacement formulation, element shapes, nodes, nodal unknowns and coordinate system, shape functions, strain displacement matrix, methods for assembling stiffness equations e.g. direct approach, Galerkin's method, virtual work method, principle of minimum potential energy; introduction to isoparametric formulation; discritization of a structure and mesh refinement, one dimensional stress-deformation and two dimensional plane stress and plane strain analysis of stress-deformation problems; numerical integration and computer application.

CE 421: Dynamics of Structures
2.00 credits, 2 hrs/week

Single degree of freedom system, free vibration response; response to harmonic, impulse and general dynamic loading; numerical evaluation of dynamic response; earthquake response of linear system; two degrees of freedom system; response spectrum analysis.

CE 433: Solid and Hazardous Waste Management
2.00 credits, 2 hrs/week

Solid Waste Management: sources and types of solid wastes; physical and chemical properties of solid wastes; solid waste generation; on-site handling, storage and processing; collection of solid wastes; transfer stations and transport; ultimate disposal methods; resources and energy recovery options; 3R strategy; Solid waste management policy in Bangladesh.

Hazardous Waste Management: identification, sources and characteristics of hazardous wastes; hospital waste management practices; legal aspects; auditing and prevention; methods of treatment and disposal – physical, chemical, biological and thermal treatment; stabilization and solidification, engineering storage, incineration, landfill and deep burial.

CE 435 Environmental Pollution Management
2.00 credits, 2 hrs/week

Water pollution: sources and types of pollutants, emerging contaminants; waste assimilation capacity of streams; dissolved oxygen modeling; ecological balance of streams; industrial pollution; lake pollution and eutrophication; heavy metal contamination; groundwater pollution; marine pollution; water quality problems in Bangladesh; 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; introduction to air quality models; air pollution monitoring and control measures; global warming, climate change and ozone layer depletion; acid rain.

Noise pollution and control measures.

CE 437: Basic Environmental Management
2.00 credits, 2 hrs/week

Introduction to environmental management; environmental policies, legislative and institutional framework; environmental implication of sectoral development; environmental quality standards; environmental impact assessment of development projects; strategic environmental assessment; environmental auditing; economics of environmental management; case studies.

CE 441: Foundation Engineering
3.00 credits, 3 hrs/week

Soil investigation techniques; types of foundations; bearing capacity of shallow and deep foundations; settlement and distortion of foundations; design and construction of footings, rafts and piles; slope stability analyses.

CE 443: Earth Retaining Structures
2.00 credits, 2 hrs/week

Foundation of structures subjected to lateral loads; rigid and flexible earth retaining structures; methods of construction: dewatering and slurry-wall construction, braced excavation, sheet piles, cofferdams, caissons.

CE 445: Elementary Soil Dynamics
2.00 credits, 2 hrs/week

Elementary vibrations; dynamic properties of soil; seismic response of soils: site effects, site amplification, liquefaction problems, remedial measures and earthquake hazards.

CE 447: Soil-water Interaction
2.00 credits, 2 hrs/week

Introduction to soil-water interaction problems: permeability, capillarity and soil suction; slopes subjected to water current, wave

action etc; theories of filters and revetment design; geotechnical design of landfills.

CE 451: Transportation Engineering II: Pavement Design and Railway Engineering
4.00 credits, 4 hrs/week

Pavement materials: bituminous binders, cement, aggregates, embankment material, soil stabilization; mix design methods; low cost roads; flexible and rigid pavement: pavement components and functions, pavement design and construction, road maintenance; railway engineering: general requirements, rolling stock and tracks, stations and yards, points and crossings, signaling, maintenance operations.

CE 452: Transportation Engineering Sessional I: Highway Materials and Traffic Engineering Design
1.50 credits, 3 hrs/week

Testing and quality control of highway materials; bituminous mix design; roadway traffic and capacity analysis; computer models and application packages.

CE 453: Transportation Engineering III: Traffic Engineering Design and Management
2.00 credits, 2 hrs/week

Advanced concepts of traffic management, management strategies; analysis of traffic flow characteristics; traffic control devises; intersection control and design; grade separation and interchanges; computer application in traffic system analysis; introduction to micro simulation and ITS; NMT issues and road safety.

CE 455: Transportation Engineering IV: Pavement Management, Drainage and Airport
2.00 credits, 2 hrs/week

Pavement management systems; evaluation and strengthening of pavements; drainage: highway drainage and drainage structures; airports: 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.

CE 457: Transportation Engineering V: Urban Transportation Planning and Management
2.00 credit, 2 hrs/week

The urban transport problems and trends; road network planning; characteristics and operation of different transit and paratransit modes, planning transit network; estimating system costs and benefits, pricing and financing, evaluation, transit users' attitude, policies and strategies for transit development in metropolitan cities; freight traffic planning and management; selected transport case studies, congestion management; safety management; environmental issues and sustainable transport.

5.2 Courses Offered by the Department of Water Resources Engineering

WRE 211: Fluid Mechanics
3.00 credit, 3 hrs/week

Fluid properties; fluid statics; kinematics of fluid flows; fluid flow concepts and basic equations- continuity equation, Bernoulli's equation, energy equation, momentum equation and forces in fluid flow; 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; pipe flow problems-pipes in series and parallel, branching pipes, pipe networks.

WRE 212: Fluid Mechanics Sessional
1.5 Credit, 3 hrs/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.

WRE 311: Open Channel Flow
4.00 Credit, 4 hrs/week
Prereq. WRE 211

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. Hydraulics of bridge and culvert.

WRE 312: Open Channel Flow Sessional
1.5 Credit, 3 hrs/week

Broad-crested weir; sluice gate; venturi flume; parshall flume; cutthroat flume; hydraulic jump; velocity distribution profile; Manning's roughness coefficient; specific force and specific energy.

WRE 451: Hydrology, Irrigation and Flood Management
3.00 Credit, 3 hrs/week

Hydrologic cycle; Weather and Hydrology; Precipitation, Evaporation and transpiration; Infiltration. Stream flow; Application of telemetry and remote sensing in hydrologic data acquisition; Rainfall-runoff relations; Hydrographs, unit hydrographs; Hydrologic routing; Statistical methods in hydrology; Introduction and Overview of irrigation; Water Law of Bangladesh; Plant-soil-water relationship; Consumptive use and estimation of irrigation water requirements; Methods of irrigation; Quality of irrigation water; Problems of irrigated land; Flood and its management

5.3 Courses Offered by the Department of Electrical and Electronic Engineering

EEE 165: Basic Electrical Technology
3.00 Credit, 3 hrs/week

Electrical units and standards; electrical network and circuit solution: series, parallel, node and mesh analysis; instantaneous current, voltage and power, effective current and voltage, average power; sinusoidal single phase RLC circuits: phasor algebra, balanced three phase circuits; electrical wiring for residential and commercial loads; introduction to transformers and induction motors.

5.4 Courses Offered by the Department of Physics

Phy 101: Physical Optics, Waves and Oscillation, Heat and Thermodynamics
3.00 Credit, 3 hrs/week

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

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

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

Phy 102: Physics Laboratory
1.50 Credit, 3 hrs/week

Determination of line frequency by Lissajous figures using an oscilloscope and a function generator and verification of the calibration of time/div knob at a particular position for different frequencies; determination of frequency of a tuning fork by Melde's apparatus; determination of the spring constant and the effective mass of a loaded spring; to draw magnetic induction versus current curve for a circular coil using Biot-Savart law and hence to verify tangent law; determination of the moment of inertia of a fly-wheel about its axis of rotation; determination of rigidity modulus of the material of a wire by static method; determination of the pressure-coefficient of air by constant volume air thermometer; determination of the thermal conductivity of a bad conductor by lee's method; to plot the thermo-electromotive force vs temperature (calibration) curve for a given thermocouple (e5); determination of the melting point of a solid using the calibration curve obtained in experiment-e5; determination of the mechanical equivalent of heat by electrical method; determination of the focal length of (i) a convex lens by displacement method and (ii) a concave lens by an auxiliary lens method; determination of the radius of curvature of a plano-convex lens by Newton's ring method; determination of specific rotation of sugar solution by a polarimeter; to verify Malus' law of polarization; determination of the threshold frequency for the material of a photocathode and hence find the value of the Planck's constant; determination of lattice constant by x-ray.

Phy 151: Structure of Matter, Electricity and Magnetism and Modern Physics
3.00 Credit, 3 hrs/week

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

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

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

5.5 Courses Offered by the Department of Chemistry

Chem 103: Chemistry I

3.00 Credit, 3 hrs/week

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger’s wave equation, electronic

configurations and properties of atoms;
Electronic configurations and properties of molecules: chemical bond, valence bond theory molecular orbital theory, shape of molecules, bond length, bond energy;
Chemistry of halogen, alkali metals, alkaline earth metals, non-metals and heavy metals;
Modern concepts of acids and bases;
Different types of solutions; properties of dilute solution; Thermo-chemistry; Electrochemistry: voltaic cells, electrolytic cells; Colloids and colloidal solution; Chemical and ionic equilibria; Chemistry of water; Chemistry of water pollution; Chemistry of cements, silicates and limes.

Chem 105: Chemistry II
3.00 Credit Hours, 3 hrs/week

Reaction Kinetics: Rate of Chemical Reactions; Order and Molecularity of Reactions, Different Types of Rate Expressions, Methods of Determining Rate and Order, Effect of Temperature on Reaction Rate and Energy of Activation.

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 Preventive Measures.

Chemistry of Environmental Pollution: Environment and Its Characteristics, Chemistry of Metal and Non-Metal Pollutants, Analytical Techniques used in Determination of Pollutants, Concepts 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 and Non-Metallic and Organic Protective Coating and Their Uses.

Chem 114: Inorganic Quantitative Analysis
1.5 Credit, 3 hrs/week

Volumetric Analysis: Acidimetry-Alkalimetry; Titrations involving redox reactions, Determination of Cu, Fe and Ca volumetrically; Determination of Ca and Mg in water.

5.6 Courses Offered by the Department of Mathematics

Math 137: Differential and Integral Calculus, Matrices
3.00 Credit, 3 hrs/week

Differential Calculus: Limit, Continuity and differentiability; Successive differentiation and Leibnitz's theorem; Expansion of functions; Indeterminate forms; Partial differentiation; Euler's theorem; Tangent and Normal; Maxima and minima of functions of single variables.

Integral Calculus: Integration by parts; Standard integrals; Integration by the method of successive reduction; Definite integrals; Beta function; Gamma function; Multiple integrals.

Matrices: Definition of different kinds of matrices; Algebra of matrices; Inverse of matrix; Rank and elementary transformation of matrices; Solution of system of linear equations; Eigen values and eigen vectors; Cayley-Hamilton theorem.

Math 139 : Differential Equations and Statistics
3.00 Credit, 3 hrs/week

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

Partial Differential Equation: Introduction, Linear and non-linear first order differential equations; Standard forms; Linear equations of

higher order; Equations of the second order with variable co-efficients.

Statistics: Measures of central tendency and standard deviation; Moments, Skewness and Kurtosis; Elementary probability theory and discontinuous probability distribution; Continuous probability distributions, e.g. normal and exponential.

Math 237: Laplace Transform and Vector Analysis
3.00 Credit, 3 hrs/week

Laplace Transforms: Definition of Laplace transforms, Sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives; The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms.

Vector Analysis: Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Position vector of a point; Scalar and vector product of two vectors and their geometrical interpretation; Triple products and multiple products of vectors; Linear dependence and independence of vectors; Definition of line, surface and volume integral; Gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications.

5.7 Courses Offered by the Department of

Humanities

Hum 185: English

2 Credit, 2 hrs/week

Introduction: current approaches to learning english, communication today.

Phonetics: phonetics and correct english pronunciation.

Syntax: vocabulary, diction and english sentence; sentence variety and style; grammatical problems.

Reading skill: readability, reading strategies, generating ideas through purposive reading, reading of selected stories, comprehension.

Writing skill: principles of effective writing; generating ideas, planning, organization and development of writing; composition, précis.

Written communication: business communication, tenders and quotations, journal articles, report.

Oral communication: dialogue, technical and scientific presentation.

Hum 217: Engineering Economics
2.00 Credit, 2 hrs/week

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

Hum 274: Developing English Language Skills
1.50 credit, 3 hrs/week

Reading skill: skimming, scanning, predicting, inferring; analysis and interpretation of texts; comprehension from literary and non-literary texts.

Writing skill: product approach, process approach: brain storming, self-evaluation, peer evaluation, revision/rewriting, teacher's evaluation; techniques of writing: comparison and contrast, problem and solution, cause and effect, classification, illustration; writing paragraph, essay and report.

Listening skill: listening to recorded texts; learning to take useful notes and answering questions.

Speaking skill: dialogue in peer work; participation in discussion and debate; extempore speech; narrating events; story telling; presentation.

Hum 353: Accounting
2.00 Credit, 2 hrs/week

Financial accounting: objectives and importance of accounting; accounting as an information system; basic accounting principles; accounting equation; recording system; accounting cycle; journal, ledger, trial balance; preparation of financial statements considering adjusting entries; financial statement analysis and interpretation.
Cost accounting: cost concepts and classification; cost-volume-profit analysis; contribution margin approach and its application, break-even analysis, target profit analysis, operating leverage; absorption costing vs variable costing; job order costing; capital budgeting; long run planning and control.

Hum 355: Sociology
2.00 credit, 2 hrs/week

Nature, scope and perspectives of sociology; stages of social research and research methods; culture and civilization; socialization and personality development; globalization; media and individual; social organization and social problem; social stratification; industrial revolution, capitalism and socialism; work and economic life; environment and human activities; climate change and global risk; population and human society; urbanization and city development; social change and technology.

Hum 375: Government
2.00 Credit, 2 hrs/week

Basic concepts of government and politics: forms of government; organs of government- legislature, executive, judiciary; functions of government; democracy; socialism; welfare state; bureaucracy; good governance; e-government.

Government and politics of Bangladesh: major administrative reforms; major amendments to the constitution- non-party caretaker government; local government; public policies; non-government

organizations (NGOs); managing development project- planning, implementation, monitoring and evaluation; constitutional bodies- election commission, comptroller and auditor general, public service commission; foreign policy of Bangladesh.

Regional and international organizations: SAARC, ASIAN, UNO.

5.8Courses Offered by the Shops

Shop 132: Workshop Sessional
1.50 Credit, 3 hrs/week

Carpentry shop (3/2 hrs/week)

Wood working tools; wood working machine: band saw, scroll saw, circular saw, jointer, thickness planer, disc sander, wood lathe; types of sawing; common cuts in wood works; types of joint; defects of timber: natural defects and artificial defects; seasoning; preservation; substitute of timber; commercial forms of timber; characteristics of good timber; use of fastening; shop practice: practical job, planning and estimating of a given job.

Machine shop (3/4 hrs/week)

Kinds of tools; common bench and hand tools; marking and layout tools, measuring tools, cutting tools, machine tools, bench work with job; drilling, shaper, lathe and milling machines: introduction, type, size and capacity, uses and applications.

Welding shop (3/4 hrs/week)

Methods of metal joints: Riveting, grooving soldering, welding; Types of welding joints and welding practice; Position of arc welding and polarty: Flat, vertical, horizontal, overhead; Electric Arc welding and its machineries; Welding of different types of materials: Low carbon steel, cast iron, brass, copper, stainless steel, aluminium; Types of electrode, fluxes and their composition; Arc welding defects; Test of Arc welding: Visual, destructive and non-destructive tests.

Types of gas welding system and gas welding equipment; Gases and types of flame; welding of different types of materials; Gas welding defects; test of gas welding.

5.9 Courses Offered by the Department of Civil Engineering (For students of other Departments)

CE 106: Engineering Drawing
1.50 credits, 3 hrs/week. (For EEE Dept.)

Introduction to CAD packages and computer-aided drafting: drawing, editing, and dimensioning of simple objects; sectional and isometric views of solid geometrical figures; plan, elevations, and sections of multi-storied buildings: drawings of electrical services of a building; familiarization with electrical services design tools.

CE 221: Mechanics of Solids
4.00 credits, 4 hrs/week. (For WRE Dept.)
Prereq. WRE 101

Stress, strain and generalized Hooke's law; deformations due to tension, compression and temperature change; axial force, shear force and bending moment diagrams of beams using method of section; stress due to symmetric bending of beams, stress due to axial load and bending; shear stresses in beams; elastic analysis of circular shafts in torsion; transformation of stresses, Mohr's circle; beam deflection using moment area method; elastic buckling of columns.

CE 222: Structural Mechanics and Materials Sessional
1.50 credits, 3 hrs/week. (For WRE Dept.)

Tension, direct shear and impact tests of mild steel specimen; slender column test; static bending test; hardness test of metals; helical spring test; determination of shear center; study of structural models: truss, beam frame.

CE 223: Structural Analysis I
3.00 credits, 3 hrs/week. (For WRE Dept.)
Prereq. CE 221

Stability and determinacy of structures; analysis of statically determinate trusses; influence lines for statically determinate beams and trusses, moving loads on beams and trusses; approximate analysis of statically indeterminate structures: portal method, cantilever method and vertical load analysis of multi storied building frames; wind and earthquake loads, code provisions.

CE 265: Structure I: Mechanics
2.00 credits, 2 hrs/week. (For Arch Dept.)

Force; equilibrium; free body diagrams; resultants and components; coplanar concurrent forces; moments and parallel coplanar forces; centroids; moment of inertia of areas; fundamental concepts of stress and strain; mechanical properties of materials.

CE 267: Structure II: Basic Mechanics of Solids
2.00 credits, 2 hrs/week. (For Arch Dept.)

Stresses and strains in members subjected to tension, compression, shear and temperature changes; shear force and bending moment diagrams for statically determinate beams and frames; flexural and shearing stresses in beams by area-moment method.

CE 271: Building Services I: Plumbing
2.00 credits, 2 hrs/week. (For Arch Dept.)

Introduction to plumbing, water requirements, water sources; water supply and distribution in buildings; sewage and sewer system, building sewer and drainage system, sewage disposal; plumbing of multistoried buildings; rural sanitation programs in Bangladesh.

CE 290: Details of Construction
1.50 credits, 3 hrs/week. (For WRE Dept.)

Types of building, components of a building, design loads, framed structure and load bearing wall structure; foundations: shallow foundation and deep foundation, site exploration, bearing capacity of soil, standard penetration test; brick masonry: types of brick, bonds in brickwork, supervision of brickwork, brick laying tools, defects and

strength on brick masonry, typical structures in brickwork, load bearing and non-load bearing walls, cavity walls, partition walls; lintels and arches: different types of lintels and arches, loading on lintels, construction of arches; stairs: different types of stairs, floors: ground floors and upper floors; roofs and roof coverings; shoring; underpinning; scaffolding and formwork; plastering, pointing, painting; distempering and white washing; cement concrete construction; sound insulation: acoustics; thermal insulation; house plumbing: water supply and wastewater drainage.

CE 291: Engineering Materials
3.00 credits, 3 hrs/week. (For WRE Dept.)

Mechanical behavior and properties of engineering materials: steel-steel products, making of steel, heat treatment, time dependent strain response and corrosion; cement: composition, manufacturing and types; bricks and blocks: manufacturing and classification based on national and international standards; aggregates: coarse and fine aggregates, types and gradation; admixtures; concrete: fresh and hardened states, mix design, durability, creep and shrinkage, non-destructive tests of concrete; mortar; lime; timber and wood products; plastics; ceramic tiles; glass; fiber reinforced polymer (FRP); ferrocement; introduction to green materials and recycled materials; concrete and steel under saline condition.

CE 292: Materials Sessional
1.50 credits, 3 hrs/week. (For WRE Dept.)

Sampling and preparation of materials to determine different properties used in civil engineering construction; tests of cement: normal consistency, initial setting time, specific gravity, fineness, soundness and compressive strength; gradation of fine and coarse aggregates, tests of aggregates: specific gravity, density, water absorption, unit weight and voids; tests for compressive strength of concrete specimens; tests of bricks: water absorption, efflorescence and compressive strength.

CE 323: Design of Concrete Structures - I
3.00 credits, 3 hrs/week. (For WRE Dept.)

Fundamental behavior of reinforced concrete and loads on structure; Introduction to strength design and alternate design methods; Flexural design of beams (singly reinforced, doubly reinforced, T-beam) using strength design method; Shear, diagonal tension and torsion of beams; Bond and anchorage of reinforcement and its detailing; Design of one-way slabs; Design of two-way edge supported slabs.

CE 324: Concrete Structures Design Sessional I
1.50 credits, 3 hrs/week. (For WRE Dept.)

Design and detailing of a slab bridge; design and detailing of a balanced cantilever bridge; design and detailing of a PC Girder Bridge

CE 325: Design of Concrete Structures - II
3.00 credits, 3 hrs/week. (For WRE Dept.)
Prereq. CE 323

Design of column supported slabs; introduction to floor systems; design of columns under uniaxial and biaxial loading, introduction to slender column; structural design of footings, pile caps; seismic detailing; shear wall; structural forms; introduction to prestressed concrete; analysis and preliminary design of prestressed beam sections.

CE 365: Structure III: Reinforced Concrete Design
2.00 credits, 2 hrs/week. (For Arch Dept.)

Fundamentals of reinforced concrete design; concept of WSD and USD methods; analysis and design of reinforced beams by USD; design of slabs, one-way and two-ways; reinforced concrete columns and buckling; introduction to shear walls, earthquake resistant structural systems.

CE 369: Civil Engineering Materials & Structural Forms
3.00 credits, 3 hrs/week. (For URP Dept.)

Engineering properties and uses of different construction materials - aggregates, brick, cement, sand, lime, mortars, concrete and steel.

Wood properties - mechanical properties, shrinkage and seasoning, treatment and durability; Wood structures and products. Fibre-reinforced polymer (FRP) composites and its application to civil engineering, basic properties of FRP composites and FRP commercial composite products. Ferrocement - advantages and uses. Corrosion of steel in RC structures and its prevention; Uses of steel, concrete and other materials in buildings and structures; Types of foundations and their applications; Concept of bearing capacity and settlement.

Loads on buildings and structures, Estimation of approximate costs. Structural forms and systems buildings, bridges, communication and transmission structures, flyovers and intersections. Functions and types road embankments, irrigation, flood control and drainage structures.

CE 371: Environmental Engineering
4.00 credits, 4 hrs/week (For WRE Dept.)

Introduction to environmental engineering; water supply, water requirement, water sources, water quality, treatment and distribution systems, design concepts of water treatment plants. water engineering: wastewater characteristics, treatment and disposal, on site sanitation systems. solid waste management.

Introduction to environmental pollution; water, air, soil and noise pollution: Effects of pollution. Introduction to environmental management: environmental policy, legislation and environmental quality standards. Introduction to environmental impact assessment.

CE 372: Environmental Engineering Sessional
1.5 credits, 3 hrs/week. (For WRE Dept.)

Water and wastewater sampling techniques, sample preservation, physical, chemical and biological tests of water and wastewater; breakpoint chlorination, alum coagulation, sampling and laboratory analysis of air, sampling and laboratory analysis of soil and solid waste.

CE 373: Environmental Pollution and Nanomaterials
3 credits, 3 hrs/week. (For NCE Dept.)

Environmental pollution and its control: causes of water pollution: sources, types and effects of pollutants, oxygen demand in water bodies, heavy metal contamination.

Pollution control measures: quality monitoring and control. Air pollution: sources and types of pollutants, air pollution meterology, global warming, climate change, acid rain, introduction to air pollution monitoring and control. Environmental issues regarding nanomaterials: Role of nanomaterials engineering in mitigating environmental pollution, photocatalytic properties of nanomaterials in treating water and wastewater.

CE 381: Principles of Soil Mechanics
4.00 credits, 4 hrs/week. (For WRE Dept.)
Prereq. WRE 203

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 382: Geotechnical Engineering Laboratory
1.50 credits, 3 hrs/week. (For WRE Dept.)

Field identification tests of soils; 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; test of geotextiles.

CE 391: Transportation Engineering
4.00 credits, 4 hrs/week. (For WRE Dept.)

Introduction to transportation engineering; elements and modes of transportation system; considerations in the planning, financing and development of transportation system; highways: highway types, geometric design of highways; traffic characteristics, traffic studies

and traffic control devices; highway materials; design, construction and maintenance of low-cost pavements, rigid pavements and bituminous pavements.

Railways: introduction, characteristics, alignment, permanent way, stations and yards, points and crossings; airports: introduction, airport site selection, airport configurations, geometric design of landing area; introduction to waterways and terminals.

CE 392: Transportation Engineering Sessional
1.5 credits, 3 hrs/week. (For WRE Dept.)

Tests on bituminous materials; tests on sub grade and base materials; roadway capacity studies; problems on the design of roadway geometry and pavements, application of analytical, simulation and statistical packages.

CE 409: Engineering Geology and Geomorphology
3.00 credits, 3 hrs/week (For URP Dept.)

Minerals; identification of minerals, common rock forming minerals; physical properties of minerals; mineraloids rocks; types of rocks, cycle of rock change; earthquake and seismic map of Bangladesh.

Structural geology; faults; types of faults; fold and fold type; domes; basins; erosional process; quantitative analysis of erosional land forms. Channel development; channel widening; valley shape; stream terraces; alluvial flood plains; deltas and alluvial fans; channel morphology; channel patterns and the river basin; geology and geomorphology of Bangladesh.

CE 424: Concrete Structures Design Sessional II
1.50 credits, 3 hrs/week. (For WRE Dept.)

Analysis and design of low-rise RC moment frame buildings for wind and low seismic application; multi-storied RC buildings with shear wall and mat foundation for wind and high seismic application; reinforcement design and detailing at joints.

CE 425: Structural Analysis II / Analysis of Indeterminate Structures
3.00 credits, 3 hrs/week. (For WRE Dept.)
Prereq. CE 223

Stiffness properties of beam elements; stiffness method in analyzing statically indeterminate beams, plane frames and trusses subject to loads support settlements; flexibility method in solving statically indeterminate structures e.g. beams frames and trusses; qualitative influence line diagrams of statically indeterminate beams and frames.

CE 459: Transportation Engineering for Planners
3.00 credits, 3 hrs/week (For URP Dept.)

Introduction to transportation planning: concepts and theories; Road network planning: Country, Regional, and Urban area perspectives; Multi-modal issues in transport planning; Urban transport problems and trends; Characteristics of different transit and para-transit modes, Planning transit network; Transit users' attitude; Policies and strategies for transit development in metropolitan cities.

Introduction to concepts of Transportation Engineering: Traffic Flow Characteristics, Types of Roadway Intersection Control, Grade Separation and Interchanges, Freight Transportation, NMT issues, Road Safety issues, Environmental issues, and Sustainable transport concepts.

CE 467: Structure IV: Elements of Building Structure
2.00 credits, 2 hrs/week. (For Arch Dept.)

Approximate analysis of multistoried buildings for gravity and lateral loads; simple analysis of truss sections; analysis and preliminary design of steel beams and columns; introduction to pre-stressed concrete; introduction to various structural forms and system; types of foundations; concept of bearing capacity and settlement.

CE 471: Basic Environmental Engineering
3 credits, 3 hrs/week. (For URP Dept.)

Introduction to environmental engineering; human and environmental interaction.

Water Supply: objectives and basic elements of water supply system; water requirements; population prediction and water demand assessment; fire demand; planning of water supply systems - sources, abstraction, transmission, treatment, and distribution.

Sanitation: urban and rural sanitation; low-cost sanitation technologies; elements of a conventional waterborne sewerage system- collection, transportation, treatment, disposal; planning of sanitation systems. and

Solid waste management: sources and classification; on-site storage and handling; collection, transportation, and disposal; sanitary landfilling method; waste recycling and reuse.

Environmental pollution air, water, and soil, noise pollution.

CE 481: Foundation Engineering
3.00 credit, 3 hrs/week. (For WRE Dept.)
Prereq. CE 381

Soil investigation techniques; types of foundations; bearing capacity of shallow and deep foundations; settlement and distortion of foundations; design and construction of footings, rafts and piles; slope stability analyses.

CE 500: Preliminary Structural Design Sessional
1.50 credits, 3 hrs/week. (For Arch Dept.)

Preliminary analysis of multistoried building for gravity and lateral loads incorporating basic seismic resistant structural elements; preliminary proportioning of the structural elements of the building based on structural concepts developed in theory courses; laboratory testing; compression test of concrete cylinders, tension test of mild steel specimen, slender column test.