Amendments to HANDBOOK 2015

1. Introduction

Faculty of Engineering introduced the present semester based curriculum for the Bachelor of the Science of Engineering (BScEng) degree programme in 2002. Civil Engineering is one of the fields of specialisation in the BScEng degree programme. Except for revisions of few courses, no major curriculum revision was carried out in the programme since 2002. With the recent trend towards adopting the Outcome Based Education (OBE) system, it is felt that a substantial change of the programme structure and its courses is necessary. Also, there are few changes required to address the concerns and recommendations made by external examiners and reviewers, in particular those from Washington Accord, who specified the accreditation requirements to maintain the international standard of the existing BScEng degree programme in Civil Engineering specialisation. Washington Accord is a consortium of about 25 signatory countries which maintained the international standard of engineering degrees enabling their graduates to professionally practice in any of the signatory countries. In return, each member country is required to maintain the standard of the degree above that required from the Washington Accord.

The amendment to the HANDBOOK 2015 is as a result of the curriculum revision which addresses the inputs from all stakeholders namely, Industry, Institution of Engineers Sri Lanka (IESL), Washington Accord and other external reviewers, University Grants Commission, Students and Alumni. The programme educational objectives which cover the attributes required by the Washington Accord are broken down into programme objectives which are realised through the intended learning outcomes of the courses in the curriculum. The amendment replaces the pages with the same numbers in HANDBOOK 2015.

Table 3.1: Credits to be earned in each category of coursesof the specialization

Field of Specialization	Courses/ Projects	Credits for BScEng degree	Credits for BScEng degree with class honours
Chemical and Process Engineering	Core courses	**72**	**75**
	Regular core courses and designprojects	**69**	**63**
	Research projects	**03**	**12**
	Electives courses	**24**	**33**
	Technical electives	**12**	**18**
	General electives	**12**	**15**
Civil Engineering	Core courses	**81**	**84**
	Regular courses	**75**	**75**
	Multi-disciplinary design projects	**03**	**03**
	Research projects	**03**	**06**
	Electives courses	**15**	**24**
	Technical electives	**08**	**16**
	General electives	**07**	**08**
Electrical and Electronic Engineering	Core courses	**75**	**78**
	Regular courses	**72**	**72**
	Research projects	**03**	**06**
	Electives courses	**21**	**30**
	Technical electives	**09**	**15**
	General electives	**12**	**15**
Computer Engineering	Core courses	**72**	**75**
	Regular core courses and design projects	**69**	**69**
	Research projects	**03**	**06**
	Electives courses	**24**	**33**
	Technical electives	**09**	**18**
	General electives	**15**	**15**
Mechanical Engineering	Core courses	**69**	**75**
	Regular core courses and design projects	**69**	**69**
	Research projects	-	**06**
	Electives courses	**27**	**33**
	Technical electives	**15**	**18**
	General electives	**12**	**15**
Production Engineering	Core courses	**72**	**75**
	Regular core courses and design projects	**72**	**72**
	Research projects	-	**03**
	Electives courses	**24**	**33**
	Technical electives	**12**	**18**
	General electives	**12**	**15**
Industrial Training		06	06
Total		**102**	**114**

Table 5.1 Course structure for specialization in Civil Engineering

		CODE	TITLE	CREDITS	PRE-REQUISITES
YEAR 2	SEMESTER 3:	CE201	Mechanics of Materials I	3	.
		CE202	Fluid Mechanics I	3	.
		CE210	Engineering Surveying	3	.
		EE280	Introduction to Electrical Engineering I	3	.
		ME202	Mechanical Engineering for Civil Engineers	3	.
		EM201	Mathematics III	3	.
	SEMESTER 4	CE204	Geomechanics	3	CE201
		CE205	Engineering Hydrology	3	.
		CE208	Structural Analysis	3	CE201
		CE209	Building Construction	3	.
		CE219	Civil Engineering Laboratory I	1	CE201, CE202
		EM202	Mathematics IV	3	.
		MA201	Engineering Management	3	.
YEAR 3	SEMESTER 5	CE302	Environmental Engineering	3	.
		CE305	Hydraulics	3	
		CE306	Design of Structures I	3	CE208
		CE310	Geotechnical Engineering	3	CE204
		CE318	Transportation and Highway Engineering	3	.
		CE319	Civil Engineering Laboratory II	1	CE 202, CE 204
		EM315	Numerical Methods for Civil Engineers	2	-
			General Electives		
	SEMESTER 6	CE307	Finite Element Methods in Solid Mechanics	3	CE201
		CE308	Geotechnical Design	2	CE310
		CE311	Hydraulic Engineering and Design	3	.
		CE312	Design of Structures II	3	CE208
		CE316	Advanced Mechanics of Materials	2	CE201
		CE317	Civil Engineering field work	3	CE210
		CE320	Civil Engineering Laboratory III	1	CE219, CE319
			Technical Electives/ General Electives		

YEAR 4	SEMESTER 7	CE403	Construction Management	3	MA201
		CE405	Civil Engineering Project I	3	.
			Technical Electives/ General Electives		
	SEMESTER 8	CE402	Multi-Disciplinary Design Project	3	.
			Technical Electives / General Electives		
		CE406	Civil Engineering Project II to earn eligibility for Class Honours	3	CE405

Courses Offered by the Civil Engineering Department

Core Courses

CE201 Mechanics of Materials I (3 credits)
CE202 Fluid Mechanics I (3 credits)
CE204 Geomechanics (3 credits); Prerequisite: CE201
CE205 Engineering Hydrology (3 credits)
*CE207 Materials Science I (3 credits)
CE208 Structural Analysis (3 credits); Prerequisite: CE201
CE209 Building Construction (3 credits)
CE210 Engineering Surveying (3 credits)
CE219 Civil Engineering Laboratory I (1 credit) ; Prerequisite: CE201 and CE202

*CE301 Mechanics of Materials II (3 credits); Prerequisite: CE201
CE302 Environmental Engineering (3 credits)
*CE304 Fluid Mechanics II (3 credits)
CE305 Hydraulics (3 credits)
CE306 Design of Structures I (3 credits); Prerequisite:CE208
CE307 Finite Element Methods in Solid Mechanics (3 credits); Prerequisite: CE201
CE308 Geotechnical Design (2 Credits); Prerequisite: CE310
*CE309 Materials Science II (3 credits); Prerequisite: CE207
CE310 Geotechnical Engineering (3 credits); Prerequisite: CE204
CE311 Hydraulic Engineering and Design (3 credits)
CE312 Design of Structures II (3 credits); Prerequisite:CE208
CE316 Advanced Mechanics of Materials (2 credits); Prerequisite: CE201
CE317 Civil Engineering Fieldwork (3 credits)
CE318 Transportation and Highway Engineering (3 credits)
CE319 Civil Engineering Laboratory II (1 credit) ; Prerequisite: CE202 and CE204
CE320 Civil Engineering Laboratory III (1 credit) ; Prerequisite: CE219 and CE319

*CE401 Mechanics of Materials III (3 credits); Prerequisite: CE301
CE402 Multi-Disciplinary Design Project (3 credits)

CE403 Construction Management (3 credits)
CE405 Civil Engineering Project I (3 credits)
CE406 Civil Engineering Project II (3 credits); Prerequisite: CE405

*Offered for the other departments

New Core Courses Offered by other Deparetments for the Civil Engineering Students

MA201 Engineering Management (3 credits)
EM315 Nuemerical Methods for Civil Engineers (2 credits)

Technical Elective Courses (2 credits per course)

CE514 Ground Improvement and Geosynthetics
CE515 Geohazard Management
CE521 Advanced Geomechanics; Prerequisite: CE204
CE522 Foundation Engineering ; Prerequisite: CE310
CE523 Geotechnical Design and Construction; Prerequisite: CE310
CE532 Highway Engineering and Design; Prerequisite: CE318
CE533 Traffic Engineering; Prerequisite: CE318
CE534 Traffic Management; Prerequisite: CE318
CE535 Transportation Planning; Prerequisite: CE318
CE542 Hydraulic Structures; Prerequisite: CE311
CE545 Coastal Engineering and Coastal Zone Management; Prerequisite: CE311
CE553 Irrigation and Drainage Engineering; Prerequisite: CE311
CE561 Integrated River Basin Management; Prerequisite: CE205
CE568 Industrial Pollution Control; Prerequisite: CE302
CE570 Water Supply and Wastewater Engineering; Prerequisite: CE302
CE571 Environmental Health and Sanitation
CE586 Dynamics of Structures
CE587 Design of Structures III; Prerequisite: CE306, CE312
CE588 Construction Equipment and Material Management; Prerequisite: CE403
CE589 Sustainable Design and Construction
CE591 Design of High-rise Buildings; Prerequisite: CE306, CE312
CE592 Concrete Technology; Prerequisite: CE312
CE593 Construction Planning; Prerequisite: MA201
CE594 Computer Aided Structural Analysis and Design; Prerequisite: CE307
CE598 GIS and RS for Civil Engineers
CE599 Disaster Management

Technical Elective Courses offered by other Deparetments for the Civil Engineering Students

EM310 Operations Research I (3 credits) : Prerequisites GP103, GP104, EM201, EM202
EM502 Optimization (3 credits)

Department of Civil Engineering

CE201: Mechanics of Materials I (3 credits) *Prerequisite*: GP110
Course Content: Introduction to mechanics of materials, Basic sectional properties, Derivation of simple bending formula for a prismatic beam and estimation of direct stresses induced by bending, Composite sections, transformed section approach, Calculation of deflection in statically determinate beams, Estimation of shear stress variation in a beam section, Derivation of torsion formula for circular shaft, Transformation of 2D stress and strain, 2D stress-strain relationship for isotropic linear elastic materials, Introduction to 3D stress-strain relationship for isotropic linear elastic materials, Buckling of ideal struts (L35, T7, A6 =45).

CE202: Fluid Mechanics I (3 credits) *for Civil, Chemical and Mechanical Engineering Groups*
Course Content: Kinematics of fluid flow, Dynamics of fluid flow, Laminar flow and turbulent flow, Dimensional methods, Hydraulic machines. (L36, T6, A6 =45).

CE204: Geomechanics (3 credits) *Prerequisite*: CE201
Course content: Basic characteristics of soils, Elements of stress analysis, Permeability and seepage, Compressibility, Shear strength, Basic geology. (L41, T4 =45).

CE205: Engineering Hydrology (3 credits)
Course content: Hydrological processes, Hydrograph analysis, Frequency analysis, Groundwater hydrology.
(L35, T8, A4 =45).

CE207: Materials Science 1 (3 credits) *for chemical, Mechanical and Production Engineering Groups*
Course content: Important binary alloy systems, Elementary deformation theory, Plastic deformation of materials, Dislocation and deformation theory, Casting and solidification of metals, Strenghtening mechanisms and treatments, Physical metallurgy of steels, Heat treatment of steels, Corrosion and corroision prevention, Materials selection.
(L36, T4, A10 =45).

CE208: Structural Analysis (3 credits) *Prerequisite*: CE201
Course Content: Introduction to modelling concept for structural analysis, Identification of the degree of static indeterminacy of structures and check for stability, Analysis of statically determinate structures, Combined effect of bending and axial forces, Development of influence lines for statically determinate structures, Muller-Breslau principle, Calculation of deflection of statically determinate structures, Identification of the degree of kinematic indeterminacy of structures, Analysis of statically indeterminate structures, Introduction to plastic analysis of beam and frame structures. (L38, T7 =45).

CE209: Building Construction (3 credits)
Course Content: Features of building construction projects, Building planning and principles of architecture, Construction materials and techniques, Building services, Estimation and quantity surveying, Introduction to other civil engineering projects, Group project. (L38, T1, P12 =45).

CE210: Engineering Surveying (3 credits)
Course content: Plane surveying, Levelling, Setting out, Surveying in special conditions, Geodetic surveying, Advanced surveying techniques and applications. (L28, T2, P30 =45).

CE 219: Civil Engineering Laboratory I (1 credit): ***Prerequisites:*** **CE201, CE202**
Development of experimental skills; Use of experimental procedures in material testing and in mechanics of fluids, performance of standard tests used in civil engineering and interpretation of their results, (P30 =15).

CE301 Mechanics of Materials II (3 credits)*Prerequisite*: CE201
Course Content: Formulation of the general elasto-static problem, Governing equations and general principles, Analysis of stress & strain in 3D, Constitutive relations, Solution of plane stress/strain problems, Torsion of non-circular sections, Work and energy methods, Finite element formulation, Yield criteria. (L42, T3 =45).

CE302: Environmental Engineering (3 credits)
Course Content: Environmental sustainability, Water resources management, Water supply, Waste water treatment, Urban waste management, Design of wastewater management systems. (L33, T3, P16, A2 =45)

CE304 Fluid Mechanics II (3 credits)
Course Content:Potential flow; Euler equation, Irrotational motion, Superposition of plane flows, Methods of images, Circle theorem, Blasius theorem, Aerofoil theory; Hydraulic transients, Surge tanks, Water hammer; Navier-Stokes equation, Exact solutions, Laminar and turbulent boundary layers, Turbulence and diffusion processes, Convection-diffusion equation.(L39, T3, P6 =45).

CE305: Hydraulics (3 credits)
Course Content: Viscous flow, Hydraulic transients in pipes, Frictionless flow in open channel, Resistance in open channel flow, Sediment transport in open channels, Free surface flow computations. (L37, T6, A4 =45).

CE306: Design of Structures I (3 credits) *Prerequisite*: CE208
Course Content: Design concepts, Limit state concept, Safety, serviceability, durability, fire resistance and other considerations, Physical and mechanical properties of structural steel and their classifications, Behaviour of structural elements, modes of failure, application of codes of practice, standards and specifications, Design of elements in steel structures, Robustness of structures, Design of a steel building using a code of practices, Introduction to design software, Basic principles of pre-stressed concrete, Preliminary design of pre-stressed concrete beams, Analysis of pre-stressed concrete members for the serviceability limit state and plotting of the Magnel diagram, Design of tendon profile and identification of debonding locations, Computation of pre-stress losses, Analysis of pre-stressed concrete for the ultimate limit state (L28, T2, A30 =45).

CE307: Finite Element Methods in Solid Mechanics (3 credits) *Prerequisite*: CE201
Course Content: Introduction to approximate methods to solve basic engineering problems, Displacement based finite element formulation for truss structures, Displacement based finite element formulation for frame structures, Finite element formulation for 2D plane stress/strain problem, Introduction to general purpose finite element programs.
(L36, T4, A10 =45).

CE308: Geotechnical Design (2 credits) *Prerequisite*: CE310
Course Content: Geotechnical design using eurocode 7, Design for geohazards, Geological maps and plans
(L15, P30=30)

CE309 Materials Science II (3 credits)*Prerequisite*: CE207
Course Content: Special steels, Metallurgy of cast iron, Welding metallurgy, Joint design, Non-destructive testing, Mechanisms of fracture, Linear elastic fracture mechanics, Metallurgy of metal working processes (L26, T4, P30 =45).

CE310: Geotechnical Engineering (3 credits) *Prerequisite:* CE204
Course content: Stability of slopes, Lateral earth pressure & retaining walls, Shallow foundations, Deep foundations, Rocks, Site selection and site investigation, Ground improvement, sheet piles, braced excavations. (L40, T4, P2 =45).

CE311: Hydraulic Engineering and Design (3 credits)
Course content: Coastal engineering, Irrigation engineering, Hydraulic structures (L26, T3, P32 =45).

CE312: Design of Structures II (3 credits) *Prerequisite:* CE208
Course Content: Mechanical properties of concrete and reinforcement, Limit states, durability, fire resistance and other prime considerations; partial factors of safety; loading, load transfer paths, critical loading arrangements, Elastic behaviour of uncracked and cracked reinforced concrete beams, tension stiffening; serviceability considerations such as deflection and crack width, Collapse of reinforced concrete structural elements, Unbraced frames and braced frames, Design of reinforced concrete structural elements, Design of a reinforced concrete multi-storey building, Application of draughting software for reinforced concrete structural drawings, Extension of reinforced concrete design and detailing concepts for water-retaining structure applications, Design of a reinforced concrete water-retaining structure
(L29, T1, A30 =45).

CE316: Advanced Mechanics of Materials (2 credits): ***Prerequisite:*** **CE201**
Course content: Basic of general 3D elastostatic problem, governing equations and general principles, Analysis of stress and strain in 3D, constitutive relations, introduction to 2D approximations of 3D problem, Theory of plates and shells. (L27, T3 =30).

CE317: Civil Engineering Field Work (3 credits): ***Prerequisite:*** **CE210**
Course content: Survey field camp, Field exercises in irrigation engineering, Field exercises in environmental engineering, Geological field visit, Construction equipment training. (P90 =45).

CE318: Transportation and Highway Engineering (3 credits)
Course Content: Introduction to transportation engineering, Basic transportation planning and demand estimation, Highway construction materials, Highway designs, Highway maintenance, Traffic engineering, Traffic management (L38, T2, P10 =45).

CE319: Civil Engineering Laboratory II (1 credit): ***Prerequisites:*** **CE202, CE204**
Development of experimental skills; Use of experimental procedures in mechanics of materials, geotechnical and transportation engineering, hydraulic engineering; performance of standard tests used in civil engineering and interpretation of their results, (P30 =15)

CE320: Civil Engineering Laboratory III (1 credit): ***Prerequisites:*** **CE219, CE319**
Application of laboratory tests and experimental procedures in the solution of engineering problems. (P30 =15).

CE401 Mechanics of Materials III (3 credits) *Prerequisite*: CE301
Course Content: Beams on elastic foundations, Theory of plates and shells, Finite element analysis of plates and shells, Theory of plasticity, Associated flow rule and limit analysis, Slip-line field theory, Mechanics of metal forming processes(L41, T4 =45).

CE402: Multi-Disciplinary Design Project (3 credits)
Course Content: Life of an infrastructure project, Project appraisal process - Identification and estimation of costs and benefits of projects, economic and financial analysis, EIA and TIA processes, safety and sustainability considerations, Social Assessment of projects, Professional ethics, Project financing (short-term / long-term), Multi-disciplinary design project (L14, T1, A60 =45).

CE403: Construction Management (3 credits): *Prerequisite:* MA201
Course Content: Project management, Construction management, Marketing aspects of construction industry, Industrial law and civil engineering contracts, acts and laws pertaining to construction industry in Sri Lanka, Procurement process, bidding and award of contracts, Site Layout planning, Site management (L42, T3 =45).

CE405: Civil Engineering Project I (3 credits)
Course Content: Problem identification; literature survey and review; technical feasibility, environmental and social impact study; safety and ethical considerations; detailed project formulation; technical report writing and oral presentation (L6, P78 =45).

CE406: Civil Engineering Project II (3 credits) ***Prerequisite:*** **CE405**
Course Content: Continuation of CE 405 (Civil Engineering Project I): Design of experimental rigs and/or development of analysis programme, Execution of investigation, Analysis of results, Drawing logical conclusions, Oral presentation and preparation of a formal report, Writing of technical papers (P90 =45).

CE514: Ground Improvement and Geosynthetics (2 credits)
Course Content: Introduction to ground improvement and geosynthetics, Geosynthetics, Preloading, Soil stabilization, Stone columns, jet grouting, deep mixing, Other techniques of ground improvement. (L25, T3, A4 =30).

CE515: Geohazard Management (2 credits)
Course Content: Hazard management, Landslides, Earthquakes, Ground subsidence, salt water intrusion, Manmade hazards (L24, T3, A6 =30).

CE521: Advanced Geomechanics (2 credits) ***Prerequisite:*** **CE204**
Course Content: Stress-strain models of elasticity, non-linear, anisotropic and visco-elastic models, Theory of plasticity, elasto-plastic models, Limit analysis :bound theorems of plasticity and applications, Critical state soil mechanics, Cam-clay models of soil behavior, Dynamic behaviour of soils and rocks, Stress-strain behavior of rocks by mechanical and ultrasonic wave velocity methods, Analysis of geological structures (L25, T5 =30).

CE522: Foundation Engineering (2 credits) Prerequisite: CE310
Course Content: Special foundations, shallow foundations under inclined loads, foundations on slopes, Flexible design of foundations, Deep foundations, pile groups, laterally loaded piles, negative skin friction, piles in tension, Machine foundations, Foundations under difficult ground conditions, Improvement of existing foundations (L26, T4 =30).

CE523: Geotechnical Design and Construction (2 credits) Prerequisite: CE310
Course Content: Planning site investigation, Desk study and report, Site visit, Conceptual design, Detailed site investigation and report, Selection of optimal design, Design of foundations, retaining structures and slopes using computer software, Construction sequence, cost estimation.(L5, A50=30).

CE532: Highway Engineering and Design (2 credits): Prerequisite: CE318
Course Content: Introduction to highway planning and route planning, Pavement design, Highway construction material improvements, Highway construction techniques, Basic introduction to highway structures, Highway evaluation and maintenance, Introduction to computer applications in highway engineering, Highway design exercise (L22, T2, D12 =30).

CE533: Traffic Engineering (2 credits) Prerequisite: CE318
Course Content: Traffic flow characteristics and traffic flow theory, Theory of shock waves, queuing theory, Design of intersections, roundabouts and signalised intersections, Accident analysis and road safety, Design of pedestrian facilities
Parking analysis and facility design, Computer applications in traffic engineering.(L22, T2, D12=30).

CE534: Traffic Management (2 credits) Prerequisite: CE318
Course Content: Causes of urban traffic congestion: Congestion costing, Introduction to travel demand management, Traffic management: Electronic road pricing, ITS applications in traffic management, Parking management: Traffic safety: Case studies in travel demand management and urban traffic management.(L22, T2, P12=30).

CE535: Transportation Planning (2 credits): ***Prerequisite:*** **CE318**
Course Content: Transport surveys: Transportation planning process: Public mass transport, Air and maritime transport, Freight transport Transport economics, Sustainability in transport, Energy and environment in urban transport, Non-motorised transport, planning of pedestrian and bicycle facilities, Transport and land use: (L20, T4, P12 =30).

CE542: Hydraulic Structures (2 credits): Prerequisite: CE311
Course Content: Dams and outlet works, Diversion and water conveyance structures, Storm water drainage, Coastal and harbor structures (L27, T2, A2 =30).

CE545: Coastal Engineering and Coastal Zone Management (2 credits) *Prerequisite:* CE311
Course Content: Coastal environment, Coastal and estuarine hydraulics, Nearshore coastal processes, Coastal and harbor structures, Coastal zone management in Sri Lanka.(L27, T2, A2 =30).

CE553: Irrigation and Drainage Engineering (2 credits) *Prerequisite:* CE311
Course Content: Planning of irrigation and drainage development , Water requirements/Delivery systems, Methods of irrigation, Irrigation structures, Irrigation water management, Introduction to computer applications, Drainage requirements and systems (L25, T4, A2 =30).

CE561: Integrated River Basin Management (2 credits) *Prerequisite*: CE205
Course Content: Basics of integrated river basin management, Status of water resources, Management of water resources, Decision support for planning and management, Policies and goals, Catchment conservation. (L22, T5, A6 =30).

CE568: Industrial Pollution Control (2 credits) *Prerequisite*: CE302
Course content: Introduction to industrial waste, Legal and policy aspects, In-plant waste management, Industrial wastewater management, Industrial solid waste management. (L24, T1, P4, A6 =30).

CE570: Water Supply and Wastewater Engineering (2 credits): *Prerequisite:* CE302
Course Content: Water supply, Advanced water treatment, Need for wastewater treatment, Advanced wastewater treatment processes, Energy optimization, Resources recovery and reuse. (L24, T2, A8 =30).

CE571: Environmental Health and Sanitation (2 Credits): *Prerequisite:* CE302
Course Content: Introduction to water supply and sanitation, Disease outbreaks, Identify hazards and hazardous events and assess the risks, Onsite and offsite sanitary treatment methods, Microbial source tracking, Water safety plans (WSP) and sanitation safety planning (SSP) (L26, T2, P2, A2=30).

CE586: Dynamics of Structures (2 credits)
Course Content: Role of dynamic analysis in structural engineering, Single degree of freedom system, Multi degree of freedom system, Vibration control of structures (L20, T5, A10 =30).

CE587: Design of Structures III (2 credits) Prerequisites: CE306 & CE312
Course Content: Bridge load assessment, Design of simply supported /continuous PC beam, Composite PC beam design, End block design, Design of prestressed concrete slabs, Design of water retaining structures, Design of masonry structures, Structural timber design including glued-laminated members and composite sections. (L15, T4, P2, A20 =30).

CE588: Construction Equipment and Material Management (2 credits): Prerequisite: CE403
Course Content: Material management, Construction equipment management, Construction technology, Case study. (L20, T4, A12 =30).

CE589: Sustainable Design and Construction (2 credits)
Course Content: Introduction to sustainable built environment and GreenSL rating system, Global environment issues, Thermal environment conditions for human occupancy, Water efficiency, wastewater treatment and rain water harvesting, Green energy, Indoor environmental quality and sick building syndrome, Recycling and reuse of waste, Landscaping in green building technology, Rectification of existing buildings: Industrial case studies (L15, T5, A20 =30).

CE591: Design of High-rise Buildings (2 Credits): Prerequisites: CE306 & CE312
Course Content: Configurations and behaviour of high-rise buildings, Review of design of gravity load resisting systems, Lateral load resisting systems, Building services applicable to high-rise buildings, Lateral load analysis; wind and earthquakes, codes of practice, Comprehensive structural analysis and design, Use of computer software for modelling and analysis (L17, T3, A20=30).

CE592: Concrete Technology (2 Credits): Prerequisite: CE312
Course Content: Concrete as a composite, Types of cement, Chemical and mineral admixtures, Aggregate, Water, Concept of high-performance concrete, Proportioning of concrete mixes, Properties of fresh and hardened concrete, Compliance criteria, Production of concrete, Durability of concrete, Assessment of working life, Special types of concrete and their applications, Testing of concrete in structures (L28, A4 =30).

CE593: Construction Planning (2 Credits): Prerequisite: MA201
Course Content: Advanced planning techniques and resource analysis, Optimization techniques, Computer applications in project planning , Introduction to project planning software, prepare the project schedule using a project planning software for the real-life project (L17, T3, A/P20 =30).

CE594: Computer Aided Structural Analysis and Design (2 Credits): Prerequisite: CE307
Course Content: Review of basis of finite element method , Finite element formulation of plates and shells, Finite element formulation of solid element, Modelling of structures using a commercial finite element programs, Analysis of finite element models for different loading conditions using a commercial finite element programs (L20, A 20 =30).

CE598: GIS and RS for Civil Engineers (2 Credits)
Course Content: Introduction to GIS and software, Spatial data structures and sources, GIS analysis functions and operations, Layouts, reports, graphs and data interoperability, Remote sensed data and image processing techniques, Introduction to geographic positioning systems (L14, T1, P26, A4 =30).

CE599: Disaster Management (2 Credits)
Course Content: Elements of disaster management, Risk assessment and management, Geological hazards, Coastal hazards, Hydrological and meteorological hazards, Anthropogenic hazards, Fire hazards, Application of GIS & RS in disaster management, Emergency management (L26, A8 =30).

New core courses offered by other departments to the Department of Civil Engineering

MA201: Engineering Management (3 credits) offered by Department of Engineeeeirng Management
Course Content: Multitasking role of an engineering manager, Introduction to management approaches, Organizatiional aspects, Legal aspects of management and commercial law, Social aspects of management, Economic aspects of management, Financial aspects of management, Principles of project management, Ethical aspects and professional responsibility, Group projects and assignments (L36, T4, A10 =45).

EM315: Numerical Methods for Civil Engineers (2 credits) offered by Department of Engineeeeirng Mathematics
Course Content: Error Analysis, Solution to nonlinear equaltions, Nuemerical Solutions to system of linear equations, Interpolation, Approximation and curve fitting, Numerical quadrature, Numerical solutions to ordinary differential equations, Finite difference method.