COURSE CURRICULUM FOR UNDERGRADUATE STUDIES
B.Sc. IN CIVIL ENGINEERING
(4 YEARS UNDERGRADUATE PROGRAM)

DEPARTMENT OF CIVIL ENGINEERING
FACULTY OF ENGINEERING
DAFFODIL INTERNATIONAL UNIVERSITY

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Table Contents

1. Program Educational Objectives

The general objective of the BSc. in CE degree program administered by Dept. of CE is to prepare graduates to become successful in their chosen career paths. Specifically, the graduates of the program will be able to:

PEO-1:

Successfully apply analytical skills with critical thinking using mathematical, scientific and engineering principles in formulating and solving civil engineering problems;

PEO-2:

Work competently in diverse career choices on engineering decision-making and sustainable design covering one or more core civil engineering disciplines;

PEO-3:

Demonstrate professional, social and ethical leadership through effective communications, personal and professional contributions to society and environment in national and global perspectives, and commitment towards professional licensure and life-long education;

PEO-4:

Develop and promote new and improved skills considering diversity and tolerance and participate in the development of the civil engineering knowledge and practice.

2. Program Learning Outcomes

There are twelve (12) program learning outcomes (PO), which are summarized below:

(a) Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.

(b) Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)

(c) Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)

(d) Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

(e) Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6).

(f) Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)

(g) Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)

(h) Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)

(i) Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

(j) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(k) Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(l) Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

In addition to incorporating the above-listed POs, the curriculum also encompasses all the attributes of the Knowledge Profile (K1 – K8) as presented in Table 1 and as included in the PO statements. The ranges of Complex Problem Solving (P1 – P7) and Complex Engineering Activities (A1 – A5) are given in Tables 2 and 3, respectively.

Table 1: Knowledge Profile

	Attribute
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
K5	Knowledge that supports engineering design in a practice area
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
K8	Engagement with selected knowledge in the research literature of the discipline

Table 2: Range of Complex Engineering Problem Solving

Attribute	**Complex Engineering Problems** have characteristic P1 and some or all of P2 to P7:
Depth of knowledge required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	P2: Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	P3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	P4: Involve infrequently encountered issues
Extent of applicable codes	P5: Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	P6: Involve diverse groups of stakeholders with widely varying needs
Interdependence	P7: Are high level problems including many component parts or sub-problems

Table 3: Range of Complex Engineering Activities

Attribute	**Complex activities** mean (engineering) activities or projects that have some or all of the following characteristics:
Range of resources	A1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
Level of interaction	A2: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues
Innovation	A3: Involve creative use of engineering principles and research based knowledge in novel ways
Consequences for society and the environment	A4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
Familiarity	A5: Can extend beyond previous experiences by applying principles-based approaches

3. UGC requirements and proposed credits

Categories		UGC Requirements			**Proposed Credits**		
		Theory	Lab	Total	**Theory**	**Lab**	**Total**
University Requirements	Art of Living				**3**		**3**
	Employability				**3**		**3**
Language	English	3	1	4		**3**	**3**
	Bangla	3		3	**2***		**2**
General Education	Social Science	6		6	**2**		**2**
	Arts and Humanities	6		6	**2**		**2**
	Business	3		3			
Basic Science	Physics I, II	6	1	7	**6**	**1**	**7**
	Chemistry	3	1	4	**3**	**1**	**4**
Mathematics	Mathematics I, II, III, IV	12		12	**12**		**12**
Other Engineering	CSE and EEE	9		9	**5**	**2**	**7**
Civil Engineering Core	Basic	21	1	22	**21**	**1.5**	**22.5**
	Structural Engineering	9	3	12	**15**	**4.5**	**19.5**
	Environmental Engineering	6	1	7	**6**	**1.5**	**7.5**
	Geotechnical Engineering	6	1	7	**6**	**1.5**	**7.5**
	Transportation Engineering	6	1	7	**6**	**1.5**	**7.5**
	Water resource Engineering	6	1	7	**6**	**1.5**	**7.5**
	Civil Engineering practice	6		6	**3**		**3**
	Others		7	7		**9.5**	**9.5**
	Project/Thesis		4	4			
	Capstone Design					**4**	**4**
	Internships					**1.5**	**1.5**
Technical Electives	Major	6	1	7	**6**	**1.5**	**7.5**
	Minor	3	1	4	**3**	**1.5**	**4.5**
Summary	Summation	120	24	144	**110**	**37**	**147**

*** Easy Bangla for foreign students**

4. Course Designation and Numbering System

Each course is designated by a two to three letter word identifying the department and a three-digit number with the following criteria:

Divisional Code Meaning	
Code	**Meaning**
0	Basic Civil Engineering
1	Structural Engineering
2	Water Resource Engineering
3	Geotechnical Engineering
4	Environmental Engineering
5	Transportation Engineering

Course Code Meaning	
Example 1:	CE 351
CE	Civil Engineering Course
3	Level Three course
5	Transportation Engineering Course
1	Level Three (1st theory course)
Example 2:	CE 205
CE	Civil Engineering Course
2	Level Two course
0	Basic Civil Engineering
5	Level Two (3rd theory course)
Example 3:	CE 207
CE	Civil Engineering Course
2	Level Two course
0	Basic Civil Engineering
7	Level Two (4th theory course)
Example 4:	CSE 100
CSE	Computer Science Engineering Course
1	Level One course
0	Basic Civil Engineering
0	Level One (1st Lab course)
Example 5:	CE 208
CE	Civil Engineering Course
2	Level Two course
0	Basic Civil Engineering
8	Level Two (5th Lab course)

Following are the exceptions as in course code required by the university –

AOL 0223111: Art of Living & Engineering Ethics

EMP 0031411: Employability

5. Categories of Courses (T = Theory course and L = Laboratory or sessional course)

Categories	Course Code and Title	Type	Credit Hours
University Requirements			**6**
Art of Living	AOL 0223111: Art of Living & Engineering Ethics	T	3
Employability	EMP 0031411: Employability	T	3
Language			**5**
English	ENG 100: Professional English I	L	1
	ENG 102: Professional English II	L	1
	ENG 200: Professional English III	L	1
Bangla	BAN 101: Functional Bangla for Engineers	T	2
General Education			**4**
Social Science	SOS 101: Engineering Economics & Accounting	T	2
Arts and Humanities	HUM 101: History of Emergence of Bangladesh	T	2
Business	-	-	-
Basic Science			**11**
Physics	PHY 101: Physical Optics, Waves and Oscillation, Heat and Thermodynamics	T	3
	PHY 102: Physics Lab	L	1
	PHY 103: Structure of Matter, Electricity and Magnetism and Modern Physics	T	3
Chemistry	CHE 101: Chemistry	T	3
	CHE 102: Chemistry Lab	L	1
Mathematics			**12**
Mathematics	MAT 101: Differential and Integral Calculus	T	3
	MAT 103: Coordinate Geometry and Matrices	T	3
	MAT 201: Vector Analysis and Statistics	T	3
	MAT 203: Engineering Mathematics for Civil Engineers	T	3
Other Engineering			**7**
Computer Science and Engineering	CSE 100: Computer Fundamentals Lab	L	0.5
	CSE 201: Numerical Methods and Computer Programming	T	3
	CSE 202: Computer Programming Lab	L	1.5
Electrical Engineering	EEE 101: Basic Electrical Technology	T	2
Civil Engineering Core			**90**
Basic	CE 100: Computer Aided Drafting	L	1.5
	CE 101: Engineering Mechanics	T	3
	CE 103: Surveying	T	3
	CE 201: Engineering Materials	T	3
	CE 203: Engineering Geology and Geomorphology	T	3
	CE 205: Fluid Mechanics	T	3
	CE 211: Mechanics of Solids I	T	3
	CE 213: Mechanics of Solids II	T	3
Structural Engineering	CE 311: Structural Analysis	T	3
	CE 313: Design of Concrete Structure I	T	3
	CE 314: Bridge Design Sessional	L	1.5
	CE 315: Design of Concrete Structures II	T	3
	CE 317: Analysis of Indeterminate Structures	T	3

Categories	Course Code and Title	Type	Credit Hours
	CE 411: Design of Steel Structure	T	3
	CE 412: Steel Structures Design Sessional	L	1.5
	CE 416: Building Design Sessional	L	1.5
Environmental Engineering	CE 341: Water Supply Engineering	T	3
	CE 342: Water Quality Lab	L	1.5
	CE 441: Wastewater Engineering	T	3
Geotechnical Engineering	CE 331: Principles of Soil Mechanics	T	3
	CE 332: Soil Mechanics Lab	L	1.5
	CE 333: Foundation Engineering	T	3
Transportation Engineering	CE 351: Transportation Planning and Traffic Engineering	T	3
	CE 352: Highway Materials and Traffic Engineering lab	L	1.5
	CE 451: Pavement Design and Railway Engineering	T	3
Water resource Engineering	CE 321: Open Channel Flow	T	3
	CE 421: Hydrology, Irrigation and Flood Management	T	3
	CE 322: Open Channel Flow Lab	L	1.5
Civil Engineering practice	CE 401: Project Planning and Construction Management	T	3
Others	CE 200: Details of Construction Sessional	L	1
	CE 202: Engineering Materials Lab	L	1.5
	CE 204: Practical Surveying Lab	L	1.5
	CE 206: Fluid Mechanics Lab	L	1.5
	CE 208: Quantity Surveying Sessional	L	1
	CE 212: Structural Mechanics and Materials Lab	L	1.5
	CE 300: Geographic Information System (GIS) Lab	L	1.5
Capstone Design	CE 400: Capstone Project	L	4
Internships	CE 402: Industrial Training	L	1.5
Technical Electives (Major/Minor)			**12**
Structural Engineering	CE 413: Introduction to Steel Concrete Composite Structures	T	2 Major Theory +1 Major Lab and 1 Minor Theory + 1 Minor Lab = (6+1.5+ 3+1.5=12)
	CE 415: Prestressed Concrete	T	
	CE 417: Finite Element Method	T	
	CE 418: Computer Aided Design Lab	L	
	CE 419: Dynamics of Structures	T	
Water Resources Engineering	CE 422: Water Resources Design Sessional	L	
	CE 423: River Engineering	T	
	CE 425: Design of Hydraulic Structures	T	
	CE 427: Coastal and Estuarine Systems	T	
Geotechnical Engineering	CE 431: Elementary Soil Dynamics	T	
	CE 433: Earth Retaining Structures	T	
	CE 434: Foundation Design Sessional	L	
	CE 435: Soil Water Interaction	T	
Environmental Engineering	CE 442: Environmental Engineering Design Sessional	L	
	CE 443: Solid and Hazardous Waste Management	T	
	CE 445: Environmental Pollution Control	T	
	CE 447: Environmental Impact Assessment	T	
Transportation Engineering	CE 452: Pavement Design and Traffic Studies Sessional	L	
	CE 453: Highway Drainage and Airports	T	

Categories	Course Code and Title	Type	Credit Hours
	CE 455: Traffic Engineering and Management	T	
	CE 457: Transportation Planning & Economics	T	

6. Courses Offered in Different Levels and Terms

Level 1, Term 1					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
BAN 101	Functional Bangla for Engineers	2	0	2	-
CE 101	Engineering Mechanics	3	0	3	-
CHE 101	Chemistry	3	0	3	-
CHE 102	Chemistry Lab	0	2	1	-
CSE 100	Computer Fundamentals Lab	0	1	0.5	-
ENG 100	Professional English I	0	2	1	-
MAT 101	Differential and Integral Calculus	3	0	3	-
PHY 101	Physical Optics, Waves and Oscillation, Heat and Thermodynamics	3	0	3	-
	Total	**14**	**5**	**16.5**	

Level 1, Term 2					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 100	Computer Aided Drafting	0	3	1.5	CSE 100
CE 103	Surveying	3	0	3	-
EEE 101	Basic Electrical Technology	2	0	2	-
ENG 102	Professional English II	0	2	1	-
HUM 101	History of Emergence of Bangladesh	2	0	2	-
MAT 103	Coordinate Geometry and Matrices	3	0	3	-
PHY 102	Physics Lab	0	2	1	PHY 101
PHY 103	Structure of Matter, Electricity and Magnetism and Modern Physics	3	0	3	PHY 101
SOS 101	Engineering Economics & Accounting	2	0	2	-
	Total	**15**	**7**	**18.5**	

Level 2, Term 1					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 200	Details of Construction Sessional	0	2	1	-
CE 201	Engineering Materials	3	0	3	-
CE 202	Engineering Materials Lab	0	3	1.5	-
CE 204	Practical Surveying Lab	0	3	1.5	CE 103
CE 211	Mechanics of Solids I	3	0	3	CE 101
CSE 201	Numerical Methods and Computer Programming	3	0	3	
CSE 202	Computer Programming Lab	0	3	1.5	
ENG 200	Professional English III	0	2	1	-
MAT 201	Vector Analysis and Statistics	3	0	3	-
	Total	**12**	**13**	**18.5**	

Level 2, Term 2					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 203	Engineering Geology and Geomorphology	3	0	3	-
CE 205	Fluid Mechanics	3	0	3	-
CE 206	Fluid Mechanics Lab	0	3	1.5	-
AOL 0223111	Art of Living and Engineering Ethics	3	0	3	-
CE 208	Quantity Surveying Sessional	0	2	1	-
CE 212	Structural Mechanics and Materials Lab	0	3	1.5	-
CE 213	Mechanics of Solids II	3	0	3	CE 211
MAT 203	Engineering Mathematics for Civil Engineers	3	0	3	-
	Total	**15**	**8**	**19**	

Level 3, Term 1					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 311	Structural Analysis	3	0	3	CE 213
CE 313	Design of Concrete Structure I	3	0	3	-
CE 331	Principles of Soil Mechanics	3	0	3	
CE 332	Soil Mechanics Lab	0	3	1.5	
CE 341	Water Supply Engineering	3	0	3	-
CE 342	Water Quality Lab	0	3	1.5	-
CE 351	Transportation Planning and Traffic Engineering	3	0	3	-
CE 352	Highway Materials and Traffic Engineering Lab	0	3	1.5	-
	Total	**15**	**9**	**19.5**	

Level 3, Term 2					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
EMP 0031411	Employability	3	0	3	-
CE 300	Geographic Information System (GIS) Lab	0	3	1.5	-
CE 314	Bridge Design Sessional	0	3	1.5	CE 313
CE 315	Design of Concrete Structures II	3	0	3	CE 313
CE 317	Analysis of Indeterminate Structures	3	0	3	CE 311
CE 321	Open Channel Flow	3	0	3	-
CE 322	Open Channel Flow Lab	0	3	1.5	-
CE 333	Foundation Engineering	3	0	3	CE 331
	Total	**15**	**9**	**19.5**	

Level 4, Term 1					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 400	Capstone Project	0	4	2	-
CE 402	Industrial Training	0	3	1.5	-
CE 411	Design of Steel Structure	3	0	3	-
CE 416	Building Design Sessional	0	3	1.5	CE 315
CE 441	Wastewater Engineering	3	0	3	-
CE 451	Pavement Design and Railway Engineering	3	0	3	-
CE ***	Technical Electives 1 (Major)	3	0	3	-
CE ***	Technical Electives Lab (Major)	0	3	1.5	-
Total		**12**	**13**	**18.5**	

Level 4, Term 2					
Course Code	**Course Title**	**Theory (hr/wk)**	**Lab (hr/wk)**	**Credit Hours**	**Pre-requisite**
CE 400	Capstone Project	0	4	2	-
CE 401	Project Planning and Construction Management	3	0	3	-
CE 412	Steel Structures Design Sessional	0	3	1.5	-
CE 421	Hydrology, Irrigation and Flood Management	3	0	3	-
CE ***	Technical Electives 2 (Major)	3	0	3	-
CE ***	Technical Electives 1 (Minor)	3	0	3	-
CE ***	Technical Electives Lab (Minor)	0	3	1.5	-
Total		**12**	**10**	**17.0**	

7. Detail Outline of Courses

University Requirements:

EMP 0031411: Employability (3 Credits)

Introduction to Employability, Self-Assessment, Career Planning, Presentation Skills development, CV writing & Video Resume, Personal Branding tools & Profile Management, Communication Tools for jobs, Building Soft Skills for Employability, Building Tech Skills for Employability, Subjective Knowledge [Terminologies], Career Exploration, Work Environments & Company Research, Industry Exposure and Experience, Networking for jobs, Apply for jobs & Mock Interview.

AOL 0223111: Art of Living and Engineering Ethics (3.00 credits)

Coming out of the box, Learning to Learn, Parents, Life and Living, Etiquette, Personal Behaviour and Professionalism, Principles of engineering ethics; codes of ethics; individual, professional and institutional norms and values.

English:

ENG 100: Professional English I (1 Credit)

Introduction to professional English, Basic Sentence structure: Parts of sentence, Parts of speech, Subject verb agreement, Vocabulary, Reading strategy, Speaking strategy, Reading practice, Story telling, Effective oral presentation.

ENG 102: Professional English II (1 Credit)

Principles of effective writing, Writing practice, Essay writing strategy, Essay Writing: argumentative, descriptive/ expository, comparative, narrative, classification and division, cause and effect, Report writing, Reading practice, Speaking session, Effective oral presentation.

ENG 200: Professional English III (1 Credit)

Introduction to business communication, Introduction to TOEFL and IELTS, IELTS reading, writing, speaking, listening, TOEFL reading, writing, speaking, listening, Writing email and letters, Research proposal writing, Professional document writing, Tender writing.

Bangla:

BAN 101: Functional Bangla for Engineers (2 Credits)

বাংলা ভাষার বিবর্তন, বাংলা ভাষার উৎস, সাধু ও চলিত বাংলা, মিশ্র-বাংলা, সাধু ভাষার বিবর্তন। আধুনিক বাংলা - আধুনিক বাংলার উৎস ও প্রয়োজনীয়তা, মিশ্র বাংলার প্রকৃতি, গঠন ও ব্যবহার, আধুনিক বাংলার প্রচার ও প্রসার।

প্রায়োগিক বাংলা - বাংলা ভাষার ক্ষেত্রসমূহ, প্রায়োগিক বাংলার ব্যাকরণ ও আচরণ, প্রায়োগিক বাংলায় ঘটনাসমূহের পর্যালোচনা।

বাংলা বনাম ইংরেজি - বাংলা না ইংরেজি, ইংরেজির বাংলা প্রতিশব্দ, ইংরেজি ও বাংলার দ্বন্দ্ব ও সমন্বয়। প্রকৌশল পেশায় বাংলা - চিঠি আদান-প্রদান, প্রস্তাবনা ও গবেষণাপত্র প্রণয়ন, নিয়োগবিধি ও দাপ্তরিক নীতিমালা গঠন, পরিবেশ ও আইনগত বিষয়ে ভাষা জ্ঞান, প্রযুক্তি শেয়ারিংএ কথ্য ও সাধু ভাষার পার্থক্য ও সমন্বয়। বুঝা, লেখা ও বলা বিষয়ে জ্ঞান আহরণ ও চর্চা। বাংলার মাহাত্ম্য ও ক্ষমতা - বাংলার গভীরতা ও পরিধি, আন্তর্জাতিক ও অন্তর্জাতিক বাংলা।

আন্তর্জাতিক ছাত্রছাত্রীদের জন্য সহজ বাংলা, দৈনন্দিন যোগাযোগ, বাংলা সংস্কৃতি।

Social Science:

SOS 101: Engineering Economics and Accounting (2 Credits)

Economics and engineering; micro and macroeconomics; theory of demand and supply and their elasticity; 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. Financial accounting; objective 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 statements 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 leverages; absorption costing vs variable costing; job order costing capital budgeting; long run planning and control.

Arts and Humanities:

HUM 101: History of Emergence of Bangladesh (2 Credits)

History: Origin of the name of Bangladesh, Bangla language and people of Bangladesh; History of Bengal: the ancient age up to 1204 A.D, the medieval age up to 1757 A.D., the modern age up to 1947 A.D., background of Bangladesh: language movement, twenty one point program, discrimination against East Pakistan, Six-Point Program and Liberation War of Bangladesh, Political Actors toward the emergence of Bangladesh, Politics and Governance in Bangladesh (1971-till date).

Physics:

PHY 101: Physical Optics, Waves and Oscillation, Heat and Thermodynamics (3 Credits)

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 Lab (1 Credit)

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 thermoelectromotive 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 103: Structure of Matter, Electricity and Magnetism and Modern Physics (3 Credits)

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.

Chemistry:

CHE 101: Chemistry (3 Credits)

Chemistry of materials: Chemistry of cement, silicates and limes. Physical and chemical properties of water. Different types solutions, concentration units. Chemical equilibria and thermo chemistry. Introduction to chemical corrosion, corrosion of metals and alloys in dry and wet environments, mechanism of corrosion, atmospheric and soil corrosion and their protective measures. Chemistry of environmental pollution: Environment and its characteristics, chemistry of toxic metals and non-metal pollutants, analytical techniques, used in the determination of pollutants, chemical concept of DO, BOD, COD and threshold odor number, chemistry involved in water treatment plants. Paints and Varnishes: Introduction to Paints and Varnishes, Pretreatment of the Surface, Metallic and Non-Metallic and Organic Protective Coating and Their Uses.

CHE 102: Chemistry Lab (1 Credit)

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

Mathematics:

MAT 101: Differential and Integral Calculus (3 Credits)

Differential Calculus: Limit, Continuity and differentiability. n-th derivatives of standard functions. Leibnit’s theorem. Rolle’s theorem, Mean value theorem. Expansion infinite and infinite forms. Indeterminate form. Partial differentiation. Euler’s theorem. Tangent and Normal. Sub-tangent and subnormal in partial and polar co-ordinates. Maxima and minima of functions of single variables. Curvature.Integral Calculus: Integration by parts. Standard integrals. Integration by the method of successive reduction. Definite integrals. Improper integrals. Beta function. Gamma function. Multiple integrals. Area, Volume of solid of revolution.

MAT 103: Coordinate Geometry and Matrices (3 Credits)

System of coordinates. Projection. Direction Cosines. Equations of planes and lines. Angles between lines and planes. Distance from a point to a plane. Co-planer lines. Shortest distance between two given straight lines. Standard equations of conicoids; spheres; ellipsoids. Hyperboloid of one sheet.

Hyperboloid of two sheets. Tangent planes. Normal lines. Condition of tangency. 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.

MAT 201: Vector Analysis and Statistics (3 credits)

Vector Analysis: Scalars and vectors, equality of vectors. Addition and subtraction of vectors. Multiplication of vectors by scalars. Position vector of a point. Resolution of vectors. Scalar and vector product of two vectors and their geometrical interpretation. Triple products and multiple products. Application to geometry and mechanics. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Definition of line, surface and volume integral. Gradient, divergence and curl of point functions. Various formulae. Gauss's theorem, stoke's theorem, Green's theorem and their applications. 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 distribution.

MAT 203: Engineering Mathematics for Civil Engineers (3 Credits)

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.

Fourier Series: Fourier series and its properties, application to engineering problem solving

Computer Science and Engineering:

CSE 100: Computer Fundamentals Lab (0.5 Credits)

Development of basic computer operating skills, Office software packages, graphics software packages, touch typing skills. Working with apps and smartphones.

CSE 201: Numerical Methods and Computer Programming (3 Credits)

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. Lab: 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.

CSE 202: Computer Programming Lab (1.50 credits)

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, open-ended problem solving.

Electrical Engineering:

EEE 101: Basic Electrical Technology (2 Credits)

Electrical units and standards. Electrical networks and circuit solution series, parallel and mesh current methods. Measurement of electrical quantities current, voltage, resistance. Measuring instruments; ammeters, voltmeters, watt meters and multimeters. Instantaneous current, voltage and power, effective current and voltage, average power. Phasor algebra (as applied to A.C. circuit analysis), sinusoidal single phase RLC circuits, balanced three phase circuits. Introduction of electrical wiring for residential and

commercial loads. Familiarization with different types of electrical machine such as D. generators and motors. A.C. alternators, motors, transformers. Working principles of transformers, induction motors. Introduction to electronics principles with dimple applications.

Civil Engineering Core: Basic

CE 100: Computer Aided Drafting (1.50 Credits)

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, open-ended drawing.

CE 103: Surveying (3 Credits)

Reconnaissance survey; linear measurements; traverse survey; triangulation, leveling and contouring; calculation of areas and volumes; problems on heights and distances; curves and curve ranging, transition curve, vertical curves; tacheometry: introduction, principles and problems on tacheometry; astronomical surveying: definition, instruments, astronomical corrections, systems of time; photogrammetry: introduction of terrestrial photography, aerial photography, reading of photo mosaic, scale; project surveying; errors in surveying; remote sensing; introduction to geographic information system (GIS) and global positioning system (GPS).

CE 101: Engineering Mechanics (3 Credits)

Units of measurements. Coplanar concurrent forces; moments and parallel coplanar forces; non-concurrent non-parallel coplanar forces; non-coplanar forces; centroids; moment of inertia of areas; moment of inertia of masses. Friction; flexible cords; plane motion; force systems that produce rectilinear motion, work, kinetic energy; power, impulse and momentum.

CE 201: Engineering Materials (3 Credits)

Properties and uses of aggregates, blocks and bricks, cement; sand, lime, mortars; concrete; concrete mix design; concrete admixtures; wood structures and properties; shrinkage and seasoning; treatment and durability; mechanical properties; wood products; advanced fiber reinforced polymer (FRP) composites and its application to civil engineering; reinforcement types, basic property of FRP composites and available FRP composite products; definition of stress and strain; plane stress and strain condition; identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials; time dependent strain response of these materials due to different types of loadings; mathematical and simple rheological modeling for prediction of creep behavior; ferrocement: advantages and uses; corrosion and prevention of steel in RC structures, offshore structures and ground applications.

CE 203: Engineering Geology and Geomorphology (3 Credits)

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 205: Fluid Mechanics (3 Credits)

Development and scope of fluid mechanics. Fluid properties. Fluid statics. Kinematics of Fluid flow. Fluid flow concepts and basic equations-continuity equation, Bernoulli’s equation, energy equation, momentum equation and forces in fluid flow. Similitude and dimensional analysis. Steady incompressible flow in pressure conduits, laminar and turbulent flow, general equation for fluid friction. Empirical equations for pipe flow. Minor losses in pipe flow. Fluid measurement: Pilot tube, orifice, mouthpiece, nozzle, venturimeter, weir, Pipe flow problems pipes in series and parallel, branching pipes,

pipe networks.

CE 211: Mechanics of Solids I (3 Credits)

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 213: Mechanics of Solids II (3 Credits)

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.

Civil Engineering Core: Structural Engineering

CE 311: Structural Analysis (3 Credits)

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 313: Design of Concrete Structure I (3 Credits)

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 314: Bridge Design Sessional (1.5 Credit)

Design and detailing of a slab bridge; design and detailing of a balanced cantilever bridge; design and detailing of a PC Girder Bridge, open-ended design.

CE 315: Design of Concrete Structures II (3 Credits)

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, **field visit to observe reinforcement detailing/placement/construction work of RCC**.

CE 317: Analysis of Indeterminate Structures (3 Credits)

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 416: Building Design Sessional (1.5 Credit)

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, open-ended design.

CE 411: Design of Steel Structure (3 Credits)

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 412: Steel Structures Design Sessional (1.5 Credit)

Computer based analysis and design of low rise moment frame building for gravity and wind loads; design of members, connections and columns bases; roof truss and bridge truss; design of members and joints of roof and bridge truss, open-ended design.

Civil Engineering Core: Environmental Engineering

CE 341: Water Supply Engineering (3 Credits)

Water Supply Engineering: introduction; water demands; water supply sources; ground water exploration: aquifer properties and ground water flow, well hydraulics, water well design, drilling, construction and maintenance; water demand for rural communities; shallow hand tube wells and deep set Tara pumps for problem areas. Surface water collection and transportation; head works; pumps and pumping machineries; water distribution system; analysis and design of distribution network; fire hydrants; water meters; leak detection; unaccounted for water. Water quality requirements; water treatment-plain sedimentation, flocculation and settlement, filtration, disinfection, miscellaneous treatment methods; low cost treatment methods for rural communities.

CE 342: Water Quality Lab (1.5 Credit)

Water and wastewater sampling techniques, sample preservation, physical, chemical, and biological test of water and wastewater, breakpoint chlorination, alum coagulation, sampling and laboratory analysis of soil and solid waste, open-ended experiment.

CE 441: Wastewater Engineering (3 Credits)

Introduction, sanitation and health; low cost sanitation technology; septic tank system. plumbing system; estimation of wastewater; wastewater collection systems; hydraulics of sewage; design, construction and managements of sanitary sewer and storm drainage system; sewer appurtenances; Microbiology of wastewater, wastewater characteristics; wastewater treatment and disposal; treatment and disposal of industrial effluents; sludge treatment and disposal; Sustainability of water and sanitation services; participatory development approach in water and sanitation sector; community management of water and sanitation services, **field visit to observe different components of water supply/wastewater treatment.**

Civil Engineering Core: Geotechnical Engineering

CE 331: Principles of Soil Mechanics (3 Credits)

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; stress distribution; permeability and seepage; stress-strain-strength characteristics of soils; compressibility and settlement behavior of soils; lateral earth pressure.

CE 332: Soil Mechanics Lab (1.5 Credits)

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, open-ended experiment.

CE 333: Foundation Engineering (3 Credits)

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, **field visit to observe soil investigation/foundation construction work.**

Civil Engineering Core: Transportation Engineering

CE 351: Transportation Planning and Traffic Engineering (3.00 credits)

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 352: Highway Materials and Traffic Engineering lab (1.5 Credits)

Tests on sub base, base and subgrade materials: Aggregate impact value; aggregate crushing value; ten percent fines value; flakiness and elongation index; angularity number determination; California bearing ratio (CBR) determination; Tests on bituminous materials: Specific gravity; penetration, ductility, solubility, loss on heating, softening point, flash and fire point; Computer aided mix design (Marshall Method); Roadway capacity and saturation flow studies; Computer aided traffic flow analysis, open-ended experiment.

CE 451: Pavement Design and Railway Engineering (3 credits)

Pavement materials: bituminous binders, cement, aggregates, embankment material, soil stabilization; Mix design methods: Marshall mix design, Hveem mix design; Low cost roads: Low cost bituminous road; 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; **field visit to observe different components of Railway tracks/ pavement construction.**

Civil Engineering Core: Water Resources Engineering

CE 321: Open Channel flow (3 Credits)

Open Channel Flow and its classification, velocity and pressure distribution, energy equation, specific energy and transition problems, critical flow and control, principles of flow measurement and devices, concept of uniform flow, Chezy's and Manning's equation, 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 and Design of channels.

CE 322: Open Channel Flow Lab (1.5 Credits)

Flow over broad-crested and sharp-crested weir, Venturi flume, Parshall flume, and Cut-throat flume. Sluice gate. Hydraulic jump. Velocity distribution profile. Manning's roughness coefficient. Specific force and specific energy, open-ended experiment.

CE 421: Hydrology, Irrigation and Flood management (3 Credits)

Hydrologic cycle. Weather and Hydrology. Precipitation, Evaporation and transpiration. Infiltration. Stream flow measurement. Application of telemetry and remote sensing in hydrologic data acquisition. Rainfall-runoff relations. Hydrographs, unit Hydrographs. Hydrologic routing. Statistical methods in hydrology. Importance of irrigation. Sources and quality of irrigation water. Soil-water relationship. Consumptive use and estimation of irrigation water requirements. Methods of irrigation. Design of irrigation canal system. Irrigation structures. Irrigation pumps. Flood and its management (structural and non-structural), **field visit to observe different components of water retaining/diverting/protection/control structures.**

Civil Engineering Core: Civil Engineering Practice

CE 401: Project Planning and Construction Management (3 Credits)

Project evaluation: cash flow and net present value, perpetuities and annuities, internal rate of return, payback period, benefit-cost ratio, real and nominal interest rate, capital budgeting, risk versus return, 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 as a process, inventory management, economic order quantity, demand forecasting – newsvendor model, labour and plant management – line balancing, legal and ethical issues in project – case study, environmental regulations, procurement – value for money (VfM). Project planning and control: planning and scheduling, PERT, CPM, resource scheduling, linear programming and application. Construction management: principles, project organization, methods and practices, technology, management of materials and equipment, site management, contracts and specifications, inspection and quality control, quality assurance, safety, economy

Civil Engineering Core: Others

CE 204: Practical Surveying Lab (1.5 Credit)

Reconnaissance survey, linear and angular measurement techniques; traverse surveying; leveling and contouring; curve setting; tacheometry; house setting, modern surveying equipment and their applications, open-ended surveying: project surveying.

CE 200: Detail of Constructions Sessional (1.0 Credits)

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, **field visit to observe different stages of construction work**.

CE 202: Engineering Materials Lab (1.5 Credit)

General discussion on preparation and properties of concrete, test for specific gravity, unit weight, voids and bulking of aggregates; moisture content and absorption of coarse and fine aggregates; normal consistency, initial setting time, soundness and fineness test of cement; direct tensile and compressive strengths of cement mortar; gradation of coarse and fine aggregates; design and testing of a concrete mix, sampling and testing of bricks for absorption, unit weight, efflorescence and compressive strength, open-ended experiment.

CE 208: Quantity Surveying Sessional (1.0 Credit)

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 212: Structural Mechanics and Materials Lab (1.5 Credits)

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 centre; study of structural models: truss, beam frame.

CE 206: Fluid Mechanics Lab (1.5 Credits)

Center of pressure. Proof of Bernoulli's. Flow through Venturimeter. Flow through orifice. Coefficient of

velocity by coordinate method. Flow through mouthpiece. Flow over V-notch. Pipe fittings. Fluid friction in pipe.

CE 300: Geographic information system (GIS) Lab (1.5 Credits)

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

Civil Engineering Core: Capstone Design

CE 400: Capstone Project (4 credits)

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, socio-economic impact and sustainability 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.

Civil Engineering Core: Internships

CE 402: Industrial Training (1.5 Credits)

Total of three weeks of work in civil engineering industry under direct supervision from faculties and professionals. Tasks may include regular job description of an engineer or data accumulation for analysis and research. The students will be required to present and submit internship report at the end of the work.

Technical Electives (Major/Minor): Structural Engineering

CE 418: Computer Aided Design Lab (1.5 Credit)

Computer based analysis of structures, beam column frame system, wind and Earthquake Loads.

CE 413: Introduction to Steel Concrete Composite Structures (3 Credits)

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: Analysis and design for torsion, shear wall, lift cores, diaphragm etc. Design of reinforcements at joints. Introduction to composite structures, advantage of composite structures, interaction between steel and concrete, shear connectors, and elastic analysis of composite beams, beam column connections, behavior of different types of composite columns, axial load capacity and interaction diagrams for composite columns.

CE 415: Prestressed Concrete (3 Credits)

Prestressed concretes: materials; pre-stressing systems, partial prestress; anchorage system, loss of prestress; beam deflections and cable layout; analysis of sections for flexure, shear, bond and bearing; design of pre-stressed sections for flexure, shear, bond and bearing; analysis of end block and composite section.

CE 417: Finite Element Method (3 Credits)

Introduction to finite element method as applied to stress analysis problems; basic equations in elasticity, matrix displacement formulation, element shapes, nodes, nodal unknown 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; discretization 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 applications.

CE 419: Dynamics of Structures (3.00 Credits)

Fundamentals of structural dynamics, single degree of freedom system, formulation of equation of motion, free vibration response; response to harmonic, periodic, impulse and general dynamic loading; numerical evaluation of dynamic response; earthquake response of linear system; two degrees of freedom

system; response spectrum analysis.

Technical Electives (Major/Minor): Water Resources Engineering

CE 422: Water Resources Design Sessional (1.5 Credits)

Soil-water relationship: soil properties, use of tensiometer, infiltration rate. Losses in irrigation system. Irrigation requirement and scheduling. Aquifer characteristics and estimation of yield from irrigation wells. Analysis of hydrologic data for irrigation and flood control. Design of irrigation and a drainage canal network. Pumps in series and parallel. Pump characteristics.

CE 423: River Engineering (3 Credits)

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

CE 425: Design of Hydraulic Structures (3 Credits)

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

CE 427: Coastal and Estuarine systems (3 Credits)

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

Technical Electives (Major/Minor): Geotechnical Engineering

CE 434: Foundation Design Lab (1.5 Credits)

Computer aided design of foundations: footing, pile and pile cap, pier, raft/mat foundations and caisson; retaining structures: shore pile, abutment, retaining walls; reinforced soils.

CE 431: Elementary Soil Dynamics (3 Credits)

Fundamentals of soil dynamics, sources and types of dynamic loading, seismology and wave propagation, strong ground motion, elementary vibrations; dynamic properties of soil; seismic response of soils: site effects, site amplification, seismic stability of structures, soil-foundation structure interaction; liquefaction problems, remedial measures and earthquake hazards.

CE 433: Earth Retaining Structures (3 Credits)

Foundation for structures subjected to lateral loads; retaining walls and abutments; operation and methods of construction, dewatering and slurry-wall construction. Flexible earth retaining structures, sheet piles, cofferdams, shore-piles, soldier piles, braced excavations, caissons.

CE 435: Soil Water Interaction (3 Credits)

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

Technical Electives (Major/Minor): Environmental Engineering

CE 442: Environmental Engineering Design Sessional (1.5 Credit)

Design of water supply and sewage system: estimation of industrial, domestic and fire demands, designing deep tube well and water distribution network; estimation of industrial, domestic and commercial wastewater generation, wastewater network design; household plumbing system design; design of water and wastewater treatment plant; computer application in environmental engineering; field visit and reporting.

CE 443: Solid and Hazardous Waste Management (3 Credits)

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

Industrial solid waste collection and disposal; hazardous waste management.

CE 445: Environmental Pollution Control (3 Credits)

Major components of the environment, population and the environment; Environment Pollution and its control: water pollution - sources and types of pollutants; waste assimilation capacity of streams; dissolved oxygen modeling; ecological balance of streams; industrial pollution; heavy metal contamination; detergent pollution and eutrophication; ground-water pollution ; marine pollution; pollution control measures - water quality monitoring and management.; Air pollution: sources and types of pollutants; urban air pollution, acid rain; effects of various pollutants on human health, materials and plants; air pollution meteorology; global warming and greenhouse effects; air pollution monitoring and control measures; ozone layer depletion; alternative energy sources.

CE 447: Environmental Impact Assessment (3 Credits)

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

Technical Electives (Major/Minor): Transportation Engineering

CE 452: Pavement Design and Traffic Studies lab (1.5 Credits)

Computer aided design of rigid and flexible pavement and air field pavements; Roadway condition survey; Traffic volume and speed study; Geometric design: Road intersection design and interchanges; Computer model and simulation packages.

CE 453: Highway Drainage and Airports (3 Credits)

Highways drainage: basic requirements of drainage system, drainage structures, drainage equipment; Evaluation and strengthening of pavements Air transportations: importance. advantages, and trends; 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 455: Traffic Engineering and Management (3 Credits)

Traffic management concepts; Traffic engineering administration and legislation, Traffic accident: types, investigations and analysis; Grade separation and interchanges, pedestrian and bicycle facilities, urban bypass; Environmental aspects of highway traffic and transportation projects; Elements of traffic flow; Urban public transportation and freight movement, city road and street networks.

CE 457: Transportation Planning and Economics (3 Credits)

The transportation planning process; Traffic demand study and forecasting; Transportation economics and financing; evaluation and analysis of transportation projects; management and monitoring; organization and implementation of transportation projects; congestion pricing, selected case studies.