

Syllabus

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

**Department of Civil Engineering
School of Science and Engineering**

University of Information Technology & Sciences (UITS)

UITS, Dhaka

April 2018

Course Requirements for Undergraduate Students in Civil Engineering,
UITS

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Course Requirements for Undergraduate Students

1. Program Name : Bachelor of Science in Civil Engineering
Department of Civil Engineering will run the program.

2. Awarded Degree:

Full Name: Bachelor of Science in Civil Engineering

Abbreviation: B.Sc. in Civil Engineering

Degree requirement: Minimum CGPA of 2.25 and total 160 credit hours.

3. Marks Distribution

Theory Courses:

Class Attendance	10%
Class Test/ Class Assessment	20%
Final Examination	70%

Lab Courses:

Attendance	20%
Lab Performance/ Reporting	30%
Quizzes	30%
Viva	20%

4. Duration of Classes

For 1 credit hour theory class the duration of the class is 60 minutes with a minimum of 50 minutes of effective lecture time.

For 1 credit hour sessional/practical/laboratory design class, the duration of the class is 120 minutes with a minimum of 100 minutes effective lecture time.

5. Semester Wise Distribution of Courses

1st Semester (8 courses)

CE 101	Engineering Mechanics	3.0	
CHEM 175	Engineering Chemistry	3.0	
MATH 153	Differential and Integral Calculus, Matrices	3.0	
PHY 175	Physical Optics, Waves and Oscillation, Heat and Thermodynamics	3.0	
GED119	History of the Emergence of Independent Bangladesh	2.0	Select One
GED117	Functional Bangla	2.0	
GED105	Bangladesh Studies	2.0	
CE 102	Civil Engineering Drawing	1.5	
CHEM 176	Engineering Chemistry Lab	1.5	
PHY 176	Engineering Physics Lab	1.5	
Total		18.5	

2nd Semester (9 courses)

CE 103	Surveying	3.0	
EEE 241	Fundamentals of Electrical Engineering	3.0	
GED 101	The Four Skills of Communication in English I	2.0	
GED 102	Developing English Language skills lab	1.5	
MATH 155	Differential Equations and Statistics	3.0	
PHY 177	Structure of Matter, Electricity and Magnetism and Modern Physics	3.0	
CE 104	Computer Aided Drafting	1.5	
CE106	Practical Surveying	1.5	
CE 108	Workshop Sessional	1.5	
Total		20.0	

3rd Semester (9 courses)

CE 201	Engineering Materials	3.0	
CE 203	Engineering Geology and Geomorphology	3.0	
CE 251	Mechanics of Solids I	3.0	
GED 153	Accounting	2.0	
MATH 257	Coordinate Geometry and Vector Analysis	3.0	
CE 202	Details of Construction Lab	1.5	
CE 204	Engineering Materials Lab	1.5	
CSE 252	Computer Programming Lab	1.5	
GED 159	Government (option)	2.0	Select One
GED 155	Sociology (option)	2.0	
GED 157	Economics (option)	2.0	
Total		20.5	

4th Semester (9 courses)

CE 209	Numerical Methods and Analysis	2.0	
CE253	Mechanics of Solids II	3.0	
MATH 259	Fourier Analysis and Laplace Transformation	3.0	
CE 241	Fluid Mechanics	3.0	
CE 311	Water Supply Engineering	3.0	
CE 304	Engineering Computation Lab	1.5	
CE 206	Quantity Surveying	1.5	
CE 208	Structural Mechanics Lab	1.5	
CE 242	Fluid Mechanics Sessional	1.5	
Total		20.0	

5th Semester (8 courses)

CE 493	Professional Practices, Communication and Ethics	3.0	
CE 351	Structural Analysis and Design I	3.0	
CE 355	Design of Concrete Structures I	3.0	

CE 313	Waste water and Sanitation Engineering	4.0	
CE 321	Principles of Soil Mechanics	4.0	
CE 494	Professional Practice and Communication Sessional	1.5	
CE 314	Environmental Engineering Lab-I	1.5	
CE 324	Geotechnical Engineering Lab-I	1.5	
Total		21.5	

6th Semester (8 courses)

CE 357	Design of Concrete Structures II	3.0	
CE 323	Foundation Engineering	3.0	
CE 353	Structural Analysis and Design II	3.0	
CE 331	Transportation Planning and Traffic Engineering	3.0	
CE 341	Open Channel Flow	3.0	
CE356	Concrete Structures Design Lab I	1.5	
CE 302	Remote Sensing and GIS Lab	1.5	
CE 342	Open Channel Flow Lab	1.5	
Total		19.5	

7th Semester (8 courses)

CE 491	Project Planning and Construction Management	3.0	
CE 359	Design of Steel Structures	3.0	
CE 451	Structural Analysis and Design III	3.0	
CE 333	Pavement Design and Railway Engineering	4.0	
CE 345	Hydrology, Irrigation Engineering and Flood Management	4.0	
CE 334	Transportation Engineering Lab-I	1.5	
CE 360	Steel Structures Design Lab	1.5	
CE 490	Project/Thesis	1.5	
Total		21.5	

8th Semester (9 courses)

CE 490	Project/Thesis	3.0	
CE 452	Concrete Structures Design Lab II	1.5	
CE495	Socio-Economic Aspects of Development Projects	3.0	Select One
CE498	Business and Career Development	3.0	
CE 453	Introduction to Finite Element Method	2.0	Select Two (Structure)
CE 455	Prestressed Concrete	2.0	
CE 457	Design of Concrete Structures III	2.0	
CE 459	Dynamics of Structures	2.0	
CE 461	Introduction to Steel-Concrete Composite Structure	2.0	
CE 454	Computer Aided Analysis and Design Sessional	1.5	Structure
CE 411	Solid and Hazardous Waste Management	2.0	Select Two (Environment)
CE 413	Environmental Pollution Management	2.0	

CE 415	Environmental and Sustainable Management	2.0	
CE 414	Environmental Engineering Lab-II	1.5	Environment
CE 421	Earth Retaining Structures	2.0	Select Two (Geotechnical)
CE 425	Soil Water Interaction	2.0	
CE423	Elementary Soil Dynamics	2.0	
CE 427	Geotechnical Earthquake Engineering	2.0	
CE 424	Geotechnical Engineering Lab-II	1.5	Geotechnical
CE 431	Traffic Planning and Management	2.0	Select Two (Transportation)
CE 433	Pavement Management, Drainage and Airport	2.0	
CE 435	Urban Transportation Planning and Management	2.0	
CE 434	Transportation Engineering Lab-II	1.5	Transportation
CE 443	Ground Water Engineering	2.0	Select Two (Water Resour.)
CE 445	River Engineering	2.0	
CE 447	Hydraulic Structures	2.0	
CE 449	Coastal Engineering	2.0	
CE 448	Water Resources Engineering Lab	1.5	Water Resour.
Total		18.5	
Grand Total		160.0	

6. Course Contents

A. General Education

1. GED 101: The Four Skills of Communication in English I (2.0 credit hours)

Introduction: current approaches to learning english, communication today.

Phonetics: phonetics and correct english pronunciation.

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

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

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

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

Oral communication: dialogue, technical and scientific presentation.

Recommended Books:

New Headway Intermediate Student & Work Book, by Liz and John Soars.

Examples from Target English.

Books: Classics (abridged) such as Oliver Twist/ Black Beauty, etc.

2. GED 102: Developing English Language Skills Lab (1.5 credit hours)

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

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

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

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

Recommended Books:

As advised by the course teacher.

3. GED 153: Accounting (2.0 credit hours)

Financial accounting: objectives and importance of accounting; accounting as an information system; basic accounting principles; accounting equation; recording system; accounting cycle; journal, ledger, trial balance; preparation of financial statements considering adjusting entries; financial statement analysis and interpretation.

Cost accounting: cost concepts and classification; cost-volume-profit analysis; contribution margin approach and its application, break-even analysis, target profit analysis, operating leverage; absorption costing vs variable costing; job order costing; capital budgeting; long run planning and control.

Recommended Books:

As advised by the course teacher.

4. GED 155: Sociology (2.00 credit hours)

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

Recommended Books:

As advised by the course teacher.

5. GED 157: Economics (2.00 credit hours)

Economics and engineering; microeconomics 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.

Recommended Books:

As advised by the course teacher.

6. GED 159: Government (2.00 credit hours)

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

Government and politics of Bangladesh: major administrative reforms; major amendments to the constitution- non-party caretaker government; local government; public policies; non government organizations (NGOs); managing development project- planning, implementation, monitoring and evaluation; constitutional bodies election commission, comptroller and auditor general, public service Commission; foreign policy of Bangladesh.

Regional and international organizations: SAARC, ASIAN, UNO.

Recommended Books:

As advised by the course teacher.

7. GED 117: Functional Bangla (2.00 credit hours)

বাংলাভাষারপ্রয়োগ ও অপপ্রয়োগ, বাংলাবানান ও ভাষাসম্পাদনা, বিরামচিহ্নেরপ্রয়োগ পত্রলিখন, জীবন-বৃত্তান্ত তৈরিকরারকাঠামো, কারণ-দর্শনো নোটিশ, অভিযোগনামাএবংতারজবাব সভারকার্য-বিবরণী (রেজুলেশন), নিয়োগবিজ্ঞপ্তি, চাকুরিরসাক্ষাৎকার-বিষয়কপত্র, নিয়োগপত্র ও যোগদানপত্র, চারিত্রিকসনদপত্র, অফিসআদেশ/ নোটিশবাবিজ্ঞপ্তি/ প্রেসবিজ্ঞপ্তি, স্যুভিনিরবাম্যগাজিনেরজন্য বাণীএবংসম্পাদকীয়রচনা, ব্যবহারিকবাংলারচনা: একুশে ফেব্রুয়ারী, মুক্তিযুদ্ধ, বাংলাভাষা, বিশ্বায়ন, আকাশসংস্কৃতি।

Recommended Books:

- ১। ড. ফজলুলহক সৈকত, *ব্যবহারিকবাংলা*, ইত্যাদি গ্রন্থ প্রকাশ, প্রথমপ্রকাশ ২০১৬
- ২। উপেন্দ্রনাথ ভট্টাচার্য, *রবীন্দ্র-কাব্য পরিক্রমা*, বাণীশিল্প, কলকাতা, দ্বিতীয়সংস্করণ ১৯৮৮
- ৩। আতাউররহমান, *নজরুলকাব্য সমীক্ষা*, কল্লোলবুক সেন্টার, নীলক্ষেত, ঢাকা, তৃতীয়সংস্করণ ১৯৯৮
- ৪। আবদুলমান্নান সৈয়দ, *জীবনানন্দ দাশ*, অবসর, বাংলাবাজার, ঢাকা, প্রথমপ্রকাশ, ১৯৯৬
- ৫। হুমায়ুনআজাদ, *শামসুররাহমান: নিঃসঙ্গ শেরপা*, আগামীপ্রকাশনী, বাংলাবাজার, ঢাকা, প্রথমপ্রকাশ, ১৯৮৪
- ৬। বীতশোকভট্টাচার্য, *কবিতারভাষাকবিতায়ভাষা*, বাণীশিল্প, কলকাতা, প্রথমপ্রকাশ ২০০৪
- ৭। অজিতকুমার ঘোষ, *নাটকেরকথা*, সাহিত্যলোক, কলকাতা, পঞ্চমসংস্করণজুন ২০০৩
- ৮। ড. ফজলুলহক সৈকত, *সাহিত্যেরসদর দরোজা*, ভাষাপ্রকাশ, প্রথমপ্রকাশ ২০১৬
- ৯। আজহারইসলাম, *বাংলাদেশের ছোটগল্প*, বিষয়-ভাবনা, স্বরূপ ও শিল্পরূপ, বাংলাএকাডেমী, ঢাকা, ১৯৯৯
- ১০। শ্রীকুমার বন্দ্যোপাধ্যায়, *বাংলাউপন্যাসেরধারা*, বাংলাদেশ সংস্করণ, বিভাস, বাংলাবাজার, ঢাকা, ২০১৬

8. GED 119: History of the Emergence of Independent Bangladesh (2.00 credit hours)

Political Geography: Principalities (Janapads)

Attempts in History for Building Undivided state of Bengal and the Partition of Indian Sub-continent-(a) Shashanka (b) The Palas and the Senas (c) The Muslim Sultanate-Ikhtiyar Uddin Muhammad Bakhtiyar Khalji, (d) The Mughals and Bengal-Revolt of the Bharo Bhuyans (e) Bengal and the British- The Battle of the Plassey, and (g) The First War of Independence –the so-called Sepoy Mutiny.

The Partition of Bengal in 1905 and its Annulment in 1911
 The India Act of 1935 and the Lahore Resolution of 1940-Bengal Pact and Deshbandu Chittaranjan Das
 Creation of Pakistan and status of Bengal within Pakistan
 The Language Movement and the Politics of United Front (Jukto- Front)
 Growing Disparity between East and West Pakistan and Struggle for Autonomy under Military Rule in Pakistan
 Bangabandhu Sheikh Mujibur Rahman and His Historic Six Point Charter, 1966
 The Agartata Conspiracy and the Mass Upsurge of 1969
 Abdication of Ayub Khan, Martial Law of 1969 and the 1970 Election
 The Liberation of 1971-Non-cooperation Movement and the historic 7th March Speech of Bangabandhu, Declaration of Independence on 26th March by Bangabandhu and his arrest, Formation of Mujibnagar Government in April, 1971, Role of Mukti Bahini, the Allied Power and the Great Powers and Surrender of the Pakistani Army on 16th December (Victory Day).
 Great Men and History- Role of Bangabandhu and the Emergence of Bangladesh

Recommended Books:

1. Sirajul Islam (ed.) *Banglapedia: National Encyclopedia of Bangladesh*, (Dhaka: Asiatic Society of Bangladesh, 2003).
2. Sirajul Islam, (ed), *History of Bangladesh, 1704-1971*, Vol. I, II and III, (Dhaka: Asiatic Society of Bangladesh, 1992) .
3. Willem van Schendel, *A History of Bangladesh* (Cambridge University Press, 2009).
4. Srinath Raghavan, 1971: *A Global History of the Creation of Bangladesh* (New Delhi: Permanent Black, 2013).
5. A. M Chowdhury and Fakrul Alam (eds.), *Bangladesh on the Threshold of the Twenty First Century* (Dhaka: Asiatic Society of Bangladesh, 2002).
6. Salahuddin Ahmed and Bazlul Mobin Chowdhury, *Bangladesh National Culture and Heritage: an introductory Reader*, (Dhaka: Independent University, Bangladesh, 2004).
7. Sheikh Mujibur Rahman, *The Unfinished Memoirs*, (Dhaka: The University Press Limited, 2012).
8. মুনতাসীর মামুন, ড. মোঃ মাহবুবুর রহমান, স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস, ঢাকা, সুবর্ণ প্রকাশনী, ২০১২।
9. ড. মোঃ মাহবুবুর রহমান, বাংলাদেশের ইতিহাস ১৯৪৭-৭১, ঢাকা, সময় প্রকাশন, ১৯৯৯।
10. ড. আবদুর রহিম, ড. আবদুল মমিন চৌধুরী, ড. এ. বি. এম. মাহমুদ, ড. সিরাজুল ইসলাম, বাংলাদেশের ইতিহাস, ঢাকা, নওরোজ কিতাকিস্তান, ১৯৭৭।

9. GED 105: Bangladesh Studies: (2.00 credit hours)

Geographical-Bangladesh-Geography- Topography and climate and Anthropology-origin and traits of Bengalie people and those of various indigenous groups, Historical-(A) Prehistory and History of the Shashanka, the Pala and the Sena up to 1203, Muslim conquest in Bengal: Sultanate and Mughal period in Bengal (1204-1757), British Conquest of India (1757-1947),Pakistani Interregnum-The Liberation War of Bangladesh(1947-1971),

Political- The Constitution of Bangladesh- The functions of the Executive, Legislative and the Judiciary, Local Government Functions, etc.,

Economic- (A) Economic growth in Bangladesh and comparisons with other countries (B) Trends in human development indicators (C) Trends in urbanization, migration and landlessness (D) Trends in birth rate, death rate and Population growth

Agricultural-the importance of Agriculture to Bangladesh: (A) Factors affecting agricultural production (B) Subsistence/food crops (C) Cash/Commercial crops (D) The impact of new technologies in agriculture-The Green Revolution.

Industrial-(A) The importance of industrialization to the development of Bangladesh (B) Types of industries

Societal-The service Sectors: (A) The informal service sector (B) Non-governmental organizations (NGOs) as service delivery organizations (C) The importance of financial sectors

Populational- Structure and Growth of Bangladesh

Educational- primary, secondary and tertiary

Religious-Muslim Society and the Hindu, Christian and Buddhist communities.

Environmental-Environmental Challenges-Global Environmental Crisis and Bangladesh

Cultural-Culture of Bangladesh: (A) Its basic characteristics, urban rural cultural differences, sub-cultural issues, cultural conflict (B) Folk Culture of Bangladesh and its special features(C) indigenous and marginalized communities in Bangladesh.

Recommended Books:

1. Sirajul Islam (ed.) *Banglapedia: National Encyclopedia of Bangladesh*, Dhaka: Asiatic Society of Bangladesh, 2003.
2. Sirajul Islam, (ed), *History of Bangladesh, 1704-1971*, Vol. I, II and III, Dhaka: Asiatic Society of Bangladesh, 1992.
3. Salahuddin Ahmed and Bazlul Mobin Chowdhury, *Bangladesh National Culture and Heritage: an introductory Reader*, Dhaka: Independent University, Bangladesh, 2004).
4. রশিদ, হারুন-অর। বাংলাদেশ: রাজনীতি সরকার ও শাসনতান্ত্রিক উন্নয়ন ১৯৫৭-২০০০। ঢাকা: নিউ এজ পাবলিকেশন্স; ২০০১.
5. Guhathakurta, Meghna and Willem Van Schendel, *The Bangladesh Reader: History, culture and Politics*: Durham and London, Duke University Press, 2013

B. Basic Sciences

10. PHY 175: Physical Optics, Waves and Oscillation, Heat and Thermodynamics (3.0 credit hours)

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 Fraunhofer 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.

Recommended Books:

Zemansky, M. W. & Duttman, R. H. (2007) *Heat and Thermodynamics*. Pearson Education India.

Halliday, D. & Resnick, R. (2010). *Physics, Volume-I*. John Wiley & Sons.

Hossain, T. (1988) *A Text Book on Heat*. Springer-Verlag.

Subramanyan, N. & Brizlal. (2000). *A Text book of Sound, Heat and Optics*. Springer.

Subramanyan, N. & Brizlal. (1964). *Properties of Matter*. Addison-Wesley Publishing Company.

Kumar, G. (2008). *Quantum Mechanics*. Firewall Media.

Ahmad, D.G. (1995). *Physics for Engineering, Volume-I*. Bangladesh Academy of Sciences.

Richard, E. S., Claus, B. & Gordon, W. V. Van (6th ed., 1998), *Fundamentals of Classical Thermodynamics*, John Wiley & Sons.

Michael, J. M. and Howard N. S. (Latest edition), *Fundamentals of Engineering Thermodynamics*, John Wiley & Sons.

Gupta & Saxena P.N., *Fundamental of Solid State Physics*.

11. PHY 177: Structure of Matter, Electricity and Magnetism and Modern Physics (3.0 credit hours)

Structure of matter : crystalline and non-crystalline solids, single crystal and polycrystal solids, unit cell, crystal systems, coordinations 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: Electric charge and Coulomb's law, Electric field, concept of electric flux and the Gauss's law- some applications of Gauss's law, Gauss's law in vector form, Electric potential, relation between electric field and electric potential, capacitance and dielectrics, gradient, Laplace's and Poisson's equations, Current, Current density, resistivity,

the magnetic field, Ampere's law, Biot-Savart law and their applications, Laws of electromagnetic induction- Maxwell's equation.

Modern Physics: Galilean relativity and Einstein's special theory of relativity; Lorentz transformation equations, Length contraction, Time dilation and mass-energy relation, photoelectric effect, Compton effect; De Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle, Constituent of atomic nucleus, Nuclear binding energy, different types of radioactivity, radioactive decay law; Nuclear reactions, nuclear fission, nuclear fusion, atomic power plant.

Mechanics: Linear momentum of a particle, linear momentum of a system of particles, conservation of linear momentum, some applications of the momentum principle; Angular momentum of a particle, angular momentum of a system of particles, Kepler's law of planetary motion, the law of universal Gravitation, the motion of planets and satellites, introductory quantum mechanics; Wave function; Uncertainty principle, postulates, Schrödinger time independent equation, expectation value, Probability, Particle in a zero potential, calculation of energy.

Recommended Books:

Edward M. P. (Vol. II), *Electricity and Magnetism*.

Kenneth S. K, *Modern Physics*.

John, R. T, *Classical Mechanics*.

Halliday, D. & Resnick, R. (2010). *Physics, Volume-II*. John Wiley & Sons.

Gupta, S.L. , Kumar, V. & Singh, S.P. (1992). *Electrodynamics*. Pragati Prakashan.

Timoshenko, S. P. & Goodier, J. N. (2013). *Theory of Elasticity*. McGraw Hill, Cambridge University Press.

Haque, Roy & Rofiqullah. (2001). *Concepts of Electricity and Magnetism*. Cengage Learning.

Baiser. (1981). *Concept of Modern Physic*. McGraw-Hill International Book.

Subrahmanyam, N. & Brizlal. (2008). *Atomic and Nuclear Physics*, S. Chand Limited.

Theraja, B. L. (1988). *Modern Physics*. R.R. Bowker.

Saxena, R.S., Gupta, R.C. & Saxena, P.N. (1995). *Solid State Devices*, Inter University Board of India

12. PHY 176: Engineering Physics Lab (1.5 credit hours)

Experiments based on theory learned in Engineering Physics I and Engineering Physics II:

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 flywheel about its axis of rotation; determination of rigidity modulus of the material of a wire by static method; determination of the pressure-coefficient of air by constant volume air thermometer; determination of the thermal conductivity of a bad conductor by Lee's method; to plot the thermo-electromotive force vs temperature (calibration) curve for a given thermocouple (e5); determination of the melting point of a solid using the calibration curve obtained in experiment-e5; determination of the mechanical equivalent of heat by electrical method; determination of the focal length of (i) a convex lens by displacement method and (ii) a concave lens by an auxiliary lens method; determination of the radius of curvature of a plano-convex lens by Newton's ring method; determination of specific

rotation of sugar solution by a polarimeter; to verify Malus' law of polarization; determination of the threshold frequency for the material of a photocathode and hence find the value of the Planck's constant; determination of lattice constant by x-ray.

13. CHEM 175: Engineering Chemistry (3.0 credit hours)

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger's wave equation, electronic configurations and properties of atoms; electronic configurations and properties of molecules: chemical bond, valence bond theory molecular orbital theory, shape of molecules, bond length, bond energy; chemistry of halogen, alkali metals, alkaline earth metals, non metals and heavy metals; modern concepts of acids and bases; different types of solutions; properties of dilute solution; thermo chemistry; electrochemistry: voltaic cells, electrolytic cells; colloids and colloidal solution; chemical and ionic equilibria; chemistry of water; chemistry of water pollution; chemistry of cements, silicates and limes.

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

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

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

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

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

Recommended books:

Ebbing, D.D.,(1998). *General Chemistry*. A.I.T.B.S.

Haider, S.Z.,(1977). *Introduction To Modern Inorganic Chemistry*. Students' Publications.

Haider, S.Z.,(1975). *Advanced Inorganic Chemistry*. Students' Publications.

Haque, M.H. & Mollah, M.Y.A.,(2009). *Principles Of Physical Chemistry*. Brothers' Publication.

Bhal & Tuli,(2009). *Essential Of Physical Chemistry*. S. Chand Limited.

14. CHEM 176: Engineering Chemistry Lab (1.5 credit hours)

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

C. Mathematics

15. MATH 153: Differential and Integral Calculus, Matrices (3.0 credit hours)

Differential calculus: limit, continuity and differentiability; successive differentiation and Leibnitz's theorem; expansion of functions; indeterminate forms; partial differentiation; Euler's theorem; tangent and normal; maxima and minima of functions of single variables.

Integral calculus: integration by parts; standard integrals; integration by the method of successive reduction; definite integrals; beta function; gamma function; multiple integrals.

Matrices: definition of different kinds of matrices; algebra of matrices; inverse of matrix; rank and elementary transformation of matrices; solution of system of linear equations; Eigen values and Eigen vectors; Cayley-Hamilton theorem.

Recommended Books:

Anton, H., Bivens, I., & Davis, S. (2005). *Calculus*. JhonWiley & Sons.

Das, B.C. & Mukharjhee, B. N. (1949). *Differential Calculus*.

Das, B.C. & Mukharjhee, B. N. (1998). *Integral Calculus*. U N Dhur.

16. MATH 155: Differential Equations and Statistics (3.0 credit hours)

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 coefficients.

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.

Recommended Books:

Ross, S. L. (1989). *Differential equations*. JhonWiley & Sons.

Rainville, E.D. & Zill, D.G. (2008). *A first course in differential equations with modeling applications by Elementary Differential Equations*. Cengage Learning.

Singhania, R. (2008). *Ordinary and Partial differential Equation*. S. Chand and Company Ltd.

17. MATH 259: Fourier Analysis & Laplace Transformation (3.0 credit hours)

Fourier Analysis: Real and complex form of Fourier series; Finite transform; Fourier Integral; Fourier transforms and their uses in solving boundary value problems of wave equations.

Laplace Transforms: Definition; Laplace transforms of some elementary functions; sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives. The unit step function; Periodic function; Some special theorems

on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms; Evaluation of improper integrals.

Recommended Books:

Spiegel, M.(1993). *Schaum's Outline series of Fourier Analysis*. McGraw-Hill.

Spiegel, M.(1965). *Schaum's Outline series of Laplace Transformation*. McGraw-Hill.

18. MATH 257: Coordinate Geometry and Vector Analysis (3.0 credit hours)

Co-ordinate Geometry: 2-Dimensional co-ordinate geometry: change of axes transformation of co-ordinates, simplification of equations of curves. 3-Dimensional co-ordinate geometry: system of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

Vector analysis: scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence and independence of vectors; definition of line, surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications

Recommended Books:

Rahman, A.F.M., & Bhattacharjee, P.K. (2005). *A Text Book of co-ordinate Geometry with Vector Analysis*. S. Chakroborty.

Rahman, A.(2001). *Linear Algebra*

Anton, H. & Rorres, C. (2010). *Elementary Linear Algebra*. John Wiley & Sons.

Lipschutz, S., & Lipson, M. (2008). *Schaum's Outline of Linear Algebra*. McGraw Hill Professional.

D. Engineering (Basic)

19. CE 101: Engineering Mechanics (3.0 credit hours)

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

Recommended Books:

Faires Virgil Morning, Chambers Sherman (3rd Edition), *Analytic Mechanics*, The Macmillan Company, New York.

Beer Ferdinand P., Johnston E. Russel, *Vector Mechanics for Engineers (Static & dynamics)*, Tata McGraw – Hill Publishers.

Timoshenko & Young, *Engineering Mechanics*, McGraw – Hill Publishers.

Shames I.H., *Engineering Mechanics (Static & dynamics)*, Prentice Hall of India.

20. CE 103: Surveying (3.0 credit hours)

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).

Recommended Books:

Shahjahan M., Aziz M.A., *A text Book of Surveying*.

Punmia B.C, Vol I (3rd Edition) *Surveying*, Laxmi Publication.

Punmia B.C, Vol III (9th Edition) *Surveying*, Laxmi Publication.

Basak N.N., *Surveying and Leveling*, Tata McGraw – Hill.

21. CE 201: Engineering Materials (3.0 credit hours)

Properties and uses of aggregates, brick, cement; sand, lime, mortars; concrete; concrete mix design; 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.

Recommended Books:

Aziz M.A., (1995), *Engineering Materials*.

Singh Gurcharan & Singh Jagdish, (1996), *Building Materials*, Standard Publishers.

Krishnaraju N, *Technology of Concrete*, CBS Publishers & Distributors.

ASTM standard method of mix design

22. CE 203: Engineering Geology and Geomorphology (3.0 credit hours)

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.

Recommended Books:

Garg S. K., *Physical & Engineering Geology*, Khanna Publishers.
Giardino, *Changing The Face of earth Engineering Geomorphology*, Amazon Books, New Delhi.
SinghPrabin, *Engineering & General Geology*, Katson Publishing House.
Valdiya K.S., *Environmental Geology*, Tata McGraw-Hill, New Delhi.
Merritts Dorothy J., Freeman W.H. (1998), *Environmental Geology- An Earth System Science Approach*, Newyork.

23. CE 251: Mechanics of Solids I (3.0 credit hours)

Concepts of stress and strain, constitutive relationships; deformations due to tension, compression and temperature change; beam statics: reactions, axial force, shear force and bending moments; axial force, shear force and bending moment diagrams using method of section and summation approach; elastic analysis of circular shafts, solid noncircular and thin walled tubular members subjected to torsion; flexural and shear stresses in beams; shear centre; thin walled pressure vessels.

Recommended Books:

Popov Egor. P., *Engineering Mechanics of Solids*, Prentice-Hall of India.
Pytel Andrew, Singer Ferdinand L. (4th Edition), *Strength of Materials*, Harper & Row Publishers.
Beer Ferdinand P. & Johnston E. Russel, *Mechanics of Materials*, Tata McGraw-Hill Publishers.
Timoshenko S., *Strength of Materials (part I&II)*, CBS Publishers & Distributors.
Gere James M., *Mechanics of Materials*, McGraw-Hill Publishers.
Nash William A., *Theory and Problems of Strength of Materials*, McGraw-Hill Book Company.

24. CE 253: Mechanics of Solids II (3.0 credit hours)

Symmetric and unsymmetric bending of beams; stress transformation, failure criteria; beam deflection by direct integration and moment area method; buckling of columns; elastic strain energy and external work; cable and cable supported structures; bolted, riveted and welded joints.

Recommended Books

Popov Egor. P., *Engineering Mechanics of Solids*, Prentice-Hall of India.
Pytel Andrew, Singer Ferdinand L. (4th Edition), *Strength of Materials*, Harper & Row Publishers.
Beer Ferdinand P. & Johnston E. Russel, *Mechanics of Materials*, Tata McGraw-Hill Publishers.
Timoshenko S., *Strength of Materials (part I & II)*, CBS Publishers & Distributors.
Gere James M., *Mechanics of Materials*, McGraw-Hill Publishers.

25. CE 241: Fluid Mechanics (3.0 credit hours)

Development and scope of fluid mechanics, fluid properties, fluid statics, kinematics of fluid flow, fluid flow concepts and basic equations, 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.

Recommended Books:

Daugherty L., Finnemore, Franjini, *Engineering Mechanics with Engineering Applications*, McGraw-Hill Book Company.

Khurmi R.S., *A Text Book of Hydraulics, Fluid Mechanics & Hydraulics Machines*, S. Chand & Company Ltd.

Streeter Victor, Wylie Benjamin, (1st SI Edition), *Fluid Mechanics*, McGraw-Hill Book Company.

Street Robert, Watters G. Z., Vennard J.K., (7th Edition), *Elementary Fluid Mechanics*, John Wiley & Sons.

Som and Biswas, *Introduction to Fluid Mechanics and Machines*, Tata McGraw-Hill Publisher.

26. EEE 241: Fundamentals of Electrical Engineering (3.0 credit hours)

Electrical units and standards; electrical network and circuit solution: series, parallel, node and mesh analysis; instantaneous current, voltage and power, effective current and voltage, average power; sinusoidal single phase RLC circuits: phasor algebra, balanced three phase circuits; Alternating current: Instantaneous and rms values of current, voltage, power, average power, Introduction to transformer and induction motors.

Recommended Books:

Boylestad Robert L., (2007), *Introductory Circuit Analysis*, 11/e, Pearson Prentice Hall, New Jersey.

Alexander Charles K., Sadiku Matthew N.O., (2004), *Fundamental of Electric circuits*, 2/e, Mc Grow Hill, New York.

Theraja B. L., A.K. (2004), *A text Book of Electrical Technology*, Vol.I: Basic Electrical Engineering, 34/e, S. Chand & Company Ltd., New Delhi.

27. MAT 267: Numerical Methods and Analysis (2.0 credit hours)

Introduction: Motivation and errors in numerical techniques. Solution of algebraic and transcendental equations: method of iteration, False Position method, Newton-Raphson method; Solution of simultaneous linear equations: Cramer's rule, Iteration method, Interpolation: diagonal and horizontal difference, differences of a polynomial, Newton's formula for forward and backward interpolation, Integration: general quadrature formula, Trapezoidal rule, Simpson's rule, Weddle's rule; Solution of ordinary differential equations: Euler's method, Picard's method, Taylor's series method, Runge-Kutta method; Least squares approximation of functions: linear and polynomial regression, fitting exponential and trigonometric functions.

Recommended Books:

Burden, R. L., & Faires, J. D.(2001). *Numerical Analysis*. Richard Strtton.
Sastry, S.S.(2012). *Introductory methods of Numerical Analysis*. Ashok K. Ghosh PHI Learning Ltd.
Hossain, M. S. *Numerical Analysis*.Titas publications.

28. CE 106: Practical Surveying (1.5 credit hours)

Linear and angular measurement techniques; traverse surveying; leveling and contouring; curve setting; tacheometry; project surveying; modern surveying equipment and their applications.

Recommended Books:

As advised by the course teacher.

29. CSE 252: Computer Programming Lab (1.5 credit hours)

Basic concepts of programming, algorithm and flowchart. Number system; internal representation of data. Element of structured programming language: constants, variables, data types, operators, expression, Formatted input/output Functions, control statement, arrays, strings, functions, pointers and file management. Fundamental of object oriented programming (OOP) techniques: object design, classes, inheritance, data abstraction, data encapsulation, polymorphism, operator overloading and templates. Development of programs related to Civil Engineering.

Recommended Books:

KochanStephen, (3rd Edition), *Programming in C*, Developer's Library, Paperback - Jul 8, 2004.
Kernighan Brian W., Ritchie Dennis, (2nd Edition), *TheC Programming Language*, Paperback - Mar 22, 1988.
Coad Peter and Nicola Jill, *Object-Oriented Programming*, Textbook Binding - Feb 3, 1993.
MullerPeter, *Introduction to Object-Oriented Programming Using C++*.
GottfriedByron, *Programming with C*.
Balagurusamy E. (2nd Edition), *Programming in ANSI C*.
Balagurusamy E. *Object oriented programming with C++*.
Deitel, *Java how to program*.
SchildtHerbert, (3rd Edition), *Tech yourself C*.

30. CE 102: Civil Engineering Drawing (1.5 credit hours)

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

Recommended Books:

Gill, *Engineering Graphics and Drafting*, Kataria & Sons.
Wareen J., Luzzadder, *Fundamentals of Engineering Drawing*, Prentice Hall of India.

31. CE 104: Computer Aided Drafting (1.5 credit hours)

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.

Recommended Books:

Omura George, *Mastering in AutoCAD ® 2006 and AutoCAD Ltd ® 2006* –, September 2005, Sybex, Inc.

32. CE 108: Workshop Sessional (1.5 credit hours)Carpentry Shop (3/2 hours per week)

Wood working tools; Wood working machine: Band saw, scroll saw, circular saw, jointer, thickness planer, disc sander, wood lathe; Types of sawing; Common cuts in wood works; Types of joint; Defects of timber; Commercial forms of timber. Characteristics of good timber; Use of fastening; Shop practice: Practical job, planning and estimating of a given job.

Machine Shop (3/4 hours per week)

Kinds of tools; Common bench and hand tools; Marking and layout tools, measuring tools, machine tools, bench work with job. Drilling, Shaper, Lathe and Milling Machines: Introduction, type, size and capacity, uses and applications.

Welding Shop (3/4 hours per week)

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

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

Recommended Books:

As advised by the course teacher.

33. CE 202: Details of Construction Lab (1.5 credit hours)

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.

Recommended Books:

Kumar Sushil, *Building Construction*, Standard Publishers, Delhi.

Punmia B.C., *Building Construction*, Laxmi Publication Pvt. Ltd. New Delhi.

Beall Christine, *Complete Construction Masonry & Concrete*, McGraw-Hill Book Company.

34. CE 204: Engineering Materials Lab (1.5 credit hours)

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

Recommended Books:

Singh Gurcharan & Singh Jagdish, (1996), *Building Materials*, Standard Publishers.

Neville A.M. & Books J.J., *Concrete Technology*, Peeson Education Ltd.

35. CE 206: Quantity Surveying (1.5 credit hours)

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.

Recommended Books:

Khan AbulFaraz, *Estimating*, Sabdik Publishers.

Pasrija, Arora, Inderjit Singh, *Estimating, Costing & Valuation (Civil)*, New Asian Publishers, Delhi.

Kohli D., Kohli R.C., *A Text Book on Estimating & Costing (Civil) With Drawings*, Ambala Ramesh Publication.

BNBC & PWD rate-charts are helpful.

36. CE 208: Structural Mechanics Lab (1.5 credit hours)

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

Recommended Books:

As advised by the course teacher.

37. CE 242: Fluid Mechanics Lab (1.5 credit hours)

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

Recommended Books:

As advised by the course teacher.

38. CE 304: Engineering Computation Lab (1.5 credit hours)

Key Applications include MS Word, Excel, PowerPoint and Access, Internet, e-mail and the impact of computers on society.

Introduction to high-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.

Recommended Books:

As advised by the course teacher.

39. CE 302: Remote Sensing and GIS Lab (1.5 credit hours)

Fundamentals of GIS, Maps and Map Projections, Scale and Coordinate system; Different types of data used in a GIS, Vector Data Structures and Raster Data Structures, Sources of GIS data, Understand the concept of spatial data; Main geographical data formats (e.g. coverage, geo-database, shapefile, grid, dxf, dwg, geotiff, GML); Data Acquisition: Digitizing, Editing; Vectorize, Rasterize; Managing Attribute Tables, Attribute Queries, Relational database; Spatial Analysis - Raster spatial analysis, Single layer vector spatial analysis, Multi-layer Vector spatial analysis, Attributes based analysis.

Recommended Books:

As advised by the course teacher.

E. Structural Engineering

40. CE 351: Structural Analysis and Design I (3.0 credit hours)

Stability and determinacy of structures; analysis of statically determinate trusses and arches; influence lines; moving loads on beams, frames and trusses; cables and cable supported structures e.g. suspension bridges.

Recommended Books:

As advised by the course teacher.

Recommended Books:

Shedd T. C. & Vawter J. (2nd Edition), *Theory of Simple Structures*, John Wiley & Sons, Inc.
Norris Charles, Wilbur J. & Utku Senol (4th Edition), *Elementary Structural Analysis*, McGraw-Hill Int'l Edition.

Timoshenko S., *Theory of Structure*, CBS Publishers & Distributors.

41. CE 353: Structural Analysis and Design II (3.0 credit hours)

Wind and earthquake loads; approximate analysis of statically statically indeterminate structures, e.g., braced trusses, portal frames, mill bent and multi storied building frames, trusses and frames by virtual work method; space trusses; analysis of statically indeterminate structures by consistent deformation.

Recommended Books:

Shedd T. C. & Vawter J. (2nd Edition), *Theory of Simple Structures*, John Wiley & Sons, Inc.
Norris Charles, Wilbur J. & Utku Senol (4th Edition), *Elementary Structural Analysis*, McGraw-Hill Int'l Edition.

Timoshenko S., *Theory of Structure*, CBS Publishers & Distributors.

42. CE 451: Structural Analysis and Design III (3.0 credit hours)

Analysis of statically indeterminate structures by slope deflection method, moment distribution and stiffness methods, member stiffness; stiffness transformations; assembly of stiffness matrices and solution for beams, frames and trusses. Flexibility matrix. Influence lines for statically indeterminate beams and frames.

Recommended Books:

Weaver William, Gere James, (2nd Edition), *Matrix Analysis of Framed Structures*, CBS Publishers & Distributors.

Norris Charles, Wilbur J. & Utku Senol, (4th Edition), *Elementary Structural Analysis*, McGraw-Hill Int'l Edition.

Kinney J. S., *Indeterminate Structural Analysis*, Oxford & IBH Publishing Company Ltd.

Wang C. K., *Statically Indeterminate Structures*, McGraw-Hill Book Company.

43. CE 355: Design of Concrete Structures I (3.0 Credit hours)

Fundamental behavior of reinforced concrete; 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; design of one way slabs; design of two-way edge supported slabs: using strip and alternate methods.

Recommended Books:

Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.

Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education).

Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6th Edition), *Reinforced Concrete Design*, John Wiley & Sons.

Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education.

Ferguson, Breen, Jirsa, *Reinforced Concrete Fundamentals*, John Wiley & Sons Inc.

Limbrunner George F. & Spigel Leonard, *Reinforced Concrete Design*, Prentice – Hall of India Pvt. Ltd.

44. CE 357: Design of Concrete Structures II (3.0 credit hours)

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

Recommended Books:

Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.

Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education).

Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6th Edition), *Reinforced Concrete Design*, John Wiley & Sons.

Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education.

Ferguson, Breen, Jirsa, *Reinforced Concrete Fundamentals*, John Wiley & Sons Inc.

Limbrunner George F. & Spigel Leonard, *Reinforced Concrete Design*, Prentice – Hall of India Pvt. Ltd.

45. CE 359: Design of Steel Structures (3.00 credit hours)

Behavioral principles and design of structural steel; design of tension members, bolted and welded connections; compression members; residual stress, local buckling, effective length; flexural members; lateral torsional buckling; design of beam-columns; connection design, moment connections, column bases; detailing of steel structures.

Recommended Books:

Gaylord & Gaylor, *Design of Steel Structures*, McGraw-Hill Inc.

46. CE 360: Steel Structures Design Lab (1.5 credit hours)

Analysis of steel structures, e.g. truss, plate girder; design of members and joints of structures; use of software in analysis and design problems.

Recommended Books:

Gaylord & Gaylor, *Design of Steel Structures*, McGraw-Hill Inc.

47. CE 356: Concrete Structures Design Lab I (1.5 credit hours)

Analysis and design problems based on the course 'Design of Concrete Structures I'; design of Slab Bridge, simple girder bridge and a low rise building.

48. CE 452: Concrete Structures Design Lab II (1.5 credit hours)

Analysis of buildings and PC girder bridges; design of multistoried RCC frame residential building and simple span PC girder bridge.

Recommended Books:

Different Manuals From AISC/AREA can be used as guideline.

F. Environmental Engineering

49. CE 311: Water Supply Engineering (3.0 credit hours)

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 tubewells and deep set Tara pumps for problem areas. State of centralized water management system in the country, Urbanization vs. recharge factors in the new towns and cities of the country, Rainwater harvesting.

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

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

Recommended Books:

Aziz M. A. (1st Edition), *Water Supply Engineering*, Hafiz Book Center, Dhaka.

Mara Duncan (1976), *Sewage Treatment in Hot Climates*, John Wiley & Sons, London.

McGheeTerence, Steel E. W. (November 1990), *Water Supply & Sewerage*, McGraw-Hill Int'l Edition.

Hammer Mark J. (4th Edition), *Water & Waste Water Treatment*, Prentice-Hall of India Pvt. Ltd.

50. CE 313: Waste Water and Sanitation Engineering (4.0 credit hours)

Wastewater engineering: introduction; water supply, sanitation and health; estimation of wastewater; wastewater collection systems; hydraulic of sewer; design, construction and maintenance of sanitary sewer and storm drainage system; sewer appurtenances; plumbing systems.

Microbiology of sewage and waste water; wastewater characteristics; preparatory, primary and secondary treatment methods and disposal; treatment and disposal of industrial effluents; sludge treatment and disposal; sanitation for low income communities – on-site sanitation systems for rural communities; low cost small bore sewerage for small townships; rural sanitation in Bangladesh.

Sustainability of water and sanitation services; participatory development approach in water and sanitation sector; community management of water and sanitation services; introduction to environment pollution; protection and management.

Recommended Books:

Ahmed M. Feroze, Rahman Md. Mujibur, (2nd Edition, 1974), *Water Supply & Sanitation*, ITN Bangladesh.

PeavyHoward, Rowe, Tchobanoglous (1985), *Environmental Engineering*, McGraw-Hill Book Company.

Mara Duncan (1976), *Sewage Treatment in Hot Climates*, John Wiley & Sons, London.

McGheeTerence, Steel E. W. (November 1990), *Water Supply & Sewerage*, McGraw-Hill Int'l Edition.

Hammer Mark J. (4th Edition), *Water & Waste Water Treatment*, Prentice-Hall of India Pvt. Ltd.

Metcalf & Eddy, (3rd Edition), *Waste Water Engineering: Treatment, Disposal, Reuse*, McGraw-Hill Inc.

Hornung William J., *Plumbing & Heating*, Prentice-Hall, Inc. Newjersy.

Babbitt Harold E., *Plumbing*, McGraw-Hill Book Company.

51. CE 314: Environmental Engineering Lab I (1.5 credit hours)

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

Recommended Books:

USEPA (U. S. Environment Protection Agency) Standard Test Method.

WHO (World Health Organization) Standard Test Method.

Hammer Mark J. (4th Edition), *Water & Waste Water Treatment*, Prentice-Hall of India Pvt. Ltd.

G. Geotechnical Engineering

52. CE 321: Principles of Soil Mechanics (4.0 credit hours)

Introduction geotechnical Engineering: formation, type and identification of soil; soil composition; soil structure and fabric; index properties of soil; engineering classification of soil; soil compaction; principles of total and effective stresses; permeability and seepage; stress-strain-strength characteristics of soil; compressibility and settlement behavior of soils; lateral earth pressure; stress distribution.

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.

Das B. M. (6th Edition), *Principles of Geotechnical Engineering*, Thomson Brooks/Cole.

Codute Donald P., *Geotechnical Engineering-Principles & Practice*, Prentice-Hall of India.

Punmia B. C. (13th Edition), *Soil Mechanics & Foundation*, Laxmi Publication, New Delhi.

53. CE 323: Foundation Engineering (3.0 credit hours)

Soil investigation techniques: settlement computation; 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 analysis.

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.

Bowles Joseph E., *Foundation Analysis & Design*, McGraw-Hill Book Company.

Codute Donald P., *Geotechnical Engineering-Principles & Practice*, Prentice-Hall of India.

Punmia B. C. (13th Edition), *Soil Mechanics & Foundation*, Laxmi Publication, New Delhi.

Scott C. R., (3rd Edition), *An Introduction to Soil Mechanics & Foundation*, Applied Science Publishers, London.

Tomlinson M. J., *Foundation Design & Construction*, Addison Wesley Longman Ltd.

Teng W. C., *Foundation Design & Construction*, McGraw-Hill Book Company.

54. CE 324: Geotechnical Engineering Lab I (1.5 credit hours)

Field identification tests; grain size analysis by sieve and hydrometer; specific gravity test; atterberg limits test; permeability tests; stress-strain-strength characteristics of soil; unconfined compression test; compaction test; relative density test; direct shear tests; consolidation tests.

Recommended Books:

Lambe T. William, (1951), *Soil Testing for Engineers*, MIT.

Day Robert W., (2001), *Soil Testing Manual: Procedure, Classification Data & Sampling Practices*, McGraw-Hill Book Company.

Hanna T. H. (1985), *Field Instrument in Geotechnical Engineering*, Trans Tech Publication, USA. ASTM or AASHTO Standard Test Method.

H. Transportation Engineering

55. CE 331: Transportation Planning and Traffic Engineering (3.0 credit hours)

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.

Recommended Books:

Rangwala, (14th Edition), *Principles of Railway Engineering*, Charter Publishing House, India.
Wright Paul H., Dixon Karen, (7th Edition), *Highway Engineering*, John Wiley & Sons, Inc.

The Asphalt Institute, *The Asphalt Hand Book*.

BRRI (Bangladesh Road Research Institute), *Manuals on Design of Flexible / Rigid Pavement*.

56. CE 333: Pavement Design and Railway Engineering (4.0 credit hours)

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

Recommended Books:

Wright Paul H., Dixon Karen, (7th Edition), *Highway Engineering*, John Wiley & Sons, Inc.
Papacostas C. S., Prevedouros P. D., (3rd Edition) *Transportation Engineering & Planning*, Prentice-Hall of India.

Kadiyali L. R., (2nd Edition), *Traffic Engineering & Transportation Planning*, Khanna Publishers.

KhistryJotin, Lal Kent, (3rd Edition), *Transportation Engineering: An Introduction*, Prentice Hall Publication.

Planning Commission, Government of Bangladesh, *Transport Sector Status Report-Transport Sector Coordination Wing*.

Ministry of Communications, Government of Bangladesh, *RHD Road Network Database: Annual Report-Roads & Highways Department*.

Bangladesh Gadget, *Road Design Standards*, September 5, 2004

Geometric Design Standards of RHD.

Information Book of Bangladesh Railway, 2004.

Hay William W *Introduction to Transportation Engineering*, John Wiley, New York.

57. CE 334: Transportation Engineering Lab I (1.5 credit hours)

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

Recommended Books:

As advised by the course teacher.

I. Water Resources Engineering

58. CE 341: Open Channel Flow (3.0 credit hours)

Open channel flow and its classification; velocity and pressure distributions; energy equation, specific energy and transition problems; critical flow and control; principles of flow measurement and devices; concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow; momentum equation and specific momentum; hydraulic jump theory and analysis of gradually varied flow;

Recommended Books:

Chow VenTe, (1959), *Open Channel Hydraulics*, McGraw-Hill Book Company.

Ranga Raju K. G., *Flow Through Open Channels*, Tata McGraw-Hill Publisher, India.

59. CE 345: Hydrology, Irrigation Engineering and Flood Management (4.0 credit hours)

Hydrologic cycle; hydrologic measurement: precipitation, evaporation and stream flow; hydrographs; plant-soil-water relationship; consumptive use and estimation of irrigation water requirements; methods of irrigation; quality of irrigation water; problems of irrigated land; flood and its management.

Recommended Books:

Garg Santosh K., (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures*, Khanna Publishers.

Hansen V., Israelsen W., Stringham, *Irrigation Principles & Practices*, John Wiley & Sons, Inc.

Majumder D.K., *Irrigation Water Management Principles & Practice*, Prentice-Hall of India Pvt. Ltd.

60. CE 342: Open Channel Flow Lab (1.5 credit hours)

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

Recommended Books:

As advised by the course teacher.

J. Civil Engineering Practice

61. CE 491: Project Planning and Construction Management (3.0 credit hours)

Project planning and evaluation; feasibility reports; cash flows, payback period, internal rate of return; benefit-cost ratio; cost-benefit analysis case studies; Planning and scheduling, PERT, CPM; resource scheduling; linear programming and application.

Principles of management; construction management: principles, project organization, methods and practices, technology, management of materials and equipments, site management, contracts and specifications, inspection and quality control, safety, economy. Conflict management; psychology in administration: human factors in management; human resource management. Demand forecasting; inventory control; stores management; procurement; legal issues in construction; environmental regulations.

Recommended Books:

Kerzner Harold, (7th Edition), *Project Management: A System Approach to Planning, Scheduling & Controlling*, John Wiley & Sons.

Riggs James L., (3rd Edition), *Production Systems: Planning Analysis & Control* John Wiley & Sons, New York.

Clough Richard H., Sears G.A., *Construction Project Management* (4th Edition) (August 2000), John Wiley & Sons.

62. CE 493: Professional Practices, Communication and Ethics (3.0 credit hours)

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

Introduction to communication concepts, modes of communication, methods of effective communication; writing reports; oral presentation of reports; writing proposals; preparing effective business messages; conducting meetings; strategies for effective speaking and successful inter personal communication; job application process, interviews and follow-ups.

Introduction to the code of ethics for Professionals. Legislation for Professionals.

Recommended Books:

Corporate Communication: Theory and Practice by Michael B. Goodman.

Corporate Communication: Strategic Adaptation for Global Practice by Michael B. Goodman, Peter B. Hirsch.

Corporate communication by Paul A. Argenti.

63. CE 494: Professional Practices and Communication Sessional (1.50 credit hours)

Application of communication theory and professional practice approaches in a controlled class room environment; this may include case study analysis, role playing, preparing small reports and proposals, class room presentations and individual reports etc.

Plumbing design- water supply (hot water and cold water) and sewage design of multistoried buildings, Rainwater Harvesting- planning and designing of rainwater storage structures, planning and design of ground water storage structures, design of rainwater harvesting filters, maintenance and monitoring of rainwater harvesting system.

Recommended Books:

As advised by the course teacher.

64. CE 495: Socio – Economic Aspects of Development Projects (3.0 credit hours)

Economics and social structure; development and economic growth; socio-economic indicators; concept of human development, human development index; gender related human development index; human poverty and human poverty index; poverty reduction strategies in Bangladesh; concepts of sustainable development; MDGs. Characteristics of development projects; human interest related aspects; population displacement; resettlement and rehabilitation strategy; Productivity; land loss, land use and land ownership patterns; fisheries and aquaculture; deforestation and afforestation; communication, commerce, industries and other economic benefits; water supply, sanitation, health and nutrition; inequalities in distribution of benefits and losses; Socio-economic impact assessment approach; socio-economic survey; case studies.

Recommended Books:

Understanding Socio-economic and Political Factors to Impact Policy Change . Report No. 36442 – GLB. The World Bank, Social Development Department, November 2006.

Independent evaluation at the Asian development bank by Oliver Serrat.

Stone, S., A. Strutt, and T. Herte. 2010. Assessing Socioeconomic Impacts of Transport Infrastructure Projects in the Greater Mekong Sub region. ADBI Working Paper 234. Tokyo: Asian Development Bank Institute. Available: <http://www.adbi.org/working-paper/2010/08/03/3976.socioeconomic.transport.infrastructure.mekong/>

65. CE 498: Business and Career Development (3.0 credit hours)

Techniques of effective communication in professional environment; writing techniques of modern business letters, memos and reports; human resource management: source of manpower, methods of selection and recruitment, development and motivating the workforce, appraisal procedures, employee compensation and benefits; basic marketing management, segmentation and market

Recommended Books:

As advised by the course teacher.

K. Optional Courses

66. CE 453: Introduction to Finite Element Method (2.0 credit hours)

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

Recommended Books:

Buchanon Georg R., *Theory & Problems of Finite Element Analysis*, McGraw-Hill Book.
Chandrupatla, D. Belegundu, *Introduction to Finite Element in Engineering*, Prentice-Hall, Inc.

67. CE 455: Prestressed Concrete (2.0 credit hours)

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

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

Recommended Books:

LinT. Y., BurnsNed H, (3rd Edition), *Prestressed Concrete*.

68. CE 457: Design of Concrete Structures III (2.0 credit hours)

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

Recommended Books:

LinT. Y., BurnsNed H, (3rd Edition), *Prestressed Concrete*, John Wiley & Sons, Inc.

Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.

Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education)

Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6th Edition), *Reinforced Concrete Design*, John Wiley & Sons.

Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education

Limbrunner George F. & Spiegel Leonard, *Reinforced Concrete Design*, Prentice – Hall of India Pvt. Ltd.

69. CE 459: Dynamics of Structures (2.0 credit hours)

Single degree of freedom system, formulation of equation of motion; free vibration response; response to harmonic, impulse and general dynamic loading; vibration analysis by Rayleigh's method; response spectra; two degrees of freedom system.

Recommended Books:

Dynamics of Structures (4th Edition) By Anil K. Chopra

Fundamentals of Structural Dynamics By Roy R. Craig, Andrew J. Kurdila

Structural Dynamics: Theory and Computation By Mario Paz

Dynamics of Structures by Clough and Tenzial,

70. CE 461: Introduction to Steel-Concrete Composite Structures (2.0 credit hours)

Introduction to composite structures; advantages of composite construction; interaction between steel and concrete, shear connectors, elastic analysis of composite beams, beam-column connections, behavior of different types of composite columns, axial load capacity and interaction diagrams for composite columns.

Recommended Books:

Steel-Concrete Composite Structures by R Narayanan

Composite Structures of Steel and Concrete: Beams, Slabs, Columns, and Frames for Buildings, 3rd Edition by R. P, Johnson

Design of Composite Steel-Concrete Structures by Lloyd. C. P. Yam

Structural Steel: Steel-concrete composite structures by N. E. Shanmugan and Y. S. Choo

71. CE 454: Computer Aided Analysis and Design Sessional (1.5 credit hours)

Computer aided analysis and design of various reinforced concrete and steel structures, e.g. high-rise building, modular bridge, water tower etc.

Recommended Books:

As advised by the course teacher.

72. CE 411: Solid and Hazardous Waste Management (2.0 credit hours)

Solid Waste Management: sources and types of solid wastes; physical and chemical properties of solid wastes; solid waste generation; onsite handling, storage and processing; collection of

solid wastes; transfer stations and transport; ultimate disposal methods; resources and energy recovery and recycling; soil pollution; industrial solid waste collection and disposal.

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

Recommended Books:

Peavy, Rowe, Tchobanoglous, *Environmental Engineering*, McGraw-Hill Inc.

Lagrega, Buckingham, J. Evans, (2nd Edition), *Hazardous Waste Management*, McGraw-Hill Book Company.

73. CE 413: Environmental Pollution Management (2.0 credit hours)

Environmental 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; groundwater pollution; marine pollution; pollution control measures: water quality monitoring and management.

Air pollution: sources and types of pollutants; effects of various pollutants on human health, materials and plants; air pollution meteorology; global warming, climate change and ozone layer depletion; acid rain; air pollution monitoring and control measures; introduction to air quality models.

Recommended Books:

Masters Gilbert M., (2nd Edition), *Introduction To Environmental Engineering & Sciences*, Prentice-Hall of India.

Vigil Kenneth, (2003), *An Introduction To Water Quality & Pollution Control*, Oregon State University Press.

74. CE 415: Environmental and Sustainable Management (2.0 credit hours)

Environment and development projects: environment and sustainable development; environmental policies and legislation; environmental implication of sectoral development; environmental quality standards; environmental issues and priorities; environmental impact assessment of development schemes-baseline studies, assessment methodologies; economics of environmental management; contemporary issues; case studies.

Recommended Books:

Environmental Impact Assessment For Developing Countries In Asia-ADB, 1997

Canter Larry W., *Environmental Impact Assessment*, McGraw-Hill Book Company.

75. CE 414: Environmental Engineering Lab II (1.5 credit hours)

Design of water supply and sewerage 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 visits and reporting.

Recommended Books:

As advised by the course teacher.

76. CE 421: Earth Retaining Structures (2.0 credit hours)

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

Recommended Books:

Bowles Joseph E, *Foundation Analysis & Design*, McGraw-Hill Book Company.
Teng W.C., *Foundation Design & Construction*, McGraw-Hill Book Company.
Schmidt Louis V., (1998), *Vibration Theory*, Asia Education Series.
Das B.M., (6th Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

77. CE 425: Soil-Water Interaction (2.0 credit hours)

Introduction to soil-water interaction problems: permeability, capillarity and soil suction; slopes subjected to water current, wave action etc; theories of filters and revetment design; geotechnical design of landfills.

Recommended Books:

Bowles Joseph E, *Foundation Analysis & Design*, McGraw-Hill Book Company.
Teng W.C., *Foundation Design & Construction*, McGraw-Hill Book Company.
Das B.M., (6th Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

78. CE 423: Elementary Soil Dynamics (2.0 credit hours)

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

Recommended Books:

Coduto Donald P., *Geotechnical Engineering: Principles & Practice*, Prentice-Hall of India.
Punmia B.C., (13th Edition), *Soil Mechanics & Foundations*, Laxmi Publication, New Delhi.
Bowles Joseph E, *Foundation Analysis & Design*, McGraw-Hill Book Company.
Teng W.C., *Foundation Design & Construction*, McGraw-Hill Book Company.
Das B.M., (6th Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

79. CE 427: Geotechnical Earthquake Engineering (2.0 credit hours)

Cyclic response of soils; local site effects; wave propagation through soil; site response analysis; liquefaction and post liquefaction behaviour; seismic hazard analysis; seismic soil-structure interaction of foundations.

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.

Bowles Joseph E., *Foundation Analysis & Design*, McGraw-Hill Book Company.

Lambe T. William, (1951), *Soil Testing for Engineers*, MIT.

Day Robert W., (2001), *Soil Testing Manual: Procedure, Classification Data & Sampling Practices*, McGraw-Hill Book Company.

Hanna T. H. (1985), *Field Instrument in Geotechnical Engineering*, Trans Tech Publication, USA.

ASTM or AASHTO Standard Test Method.

80. CE 424: Geotechnical Engineering Lab II (1.5 credit hours)

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.

81. CE 431: Traffic Planning and Management (2.0 credit hours)

The transportation planning process; traffic management concepts; traffic accident investigations; city road and street networks: grade separation and interchanges, pedestrian and bicycle facilities. The urban bypass; environmental aspects of highway traffic and transportation projects; elements of traffic flow.

Recommended Books:

Wright Paul H., Dixon Karen, (7th Edition), *Highway Engineering*, John Wiley & Sons, Inc.

Kadiyali L.R., (2nd Edition), *Traffic Engineering & Transportation Planning*, Khanna Publishers.

O'Flaherty C.A., *Highway-Traffic Planning & Engineering*, Edward Arnold, UK.

The Institute of Transportation Engineers, Transportation & Traffic Engineering Hand Book, Prentice-Hall (1982)

82. CE 433: Pavement Management, Drainage and Airport (2.0 credit hours)

Pavement management systems; evaluation and strengthening of pavements; drainage: highway drainage and drainage structures; airports: importance, advantages and trends in air transportation, planning and design of airports, aircraft characteristics related to airport design, types and elements of airport planning studies, airport configuration, geometric design of the landing area, terminal area, heliports, design of airport pavements, lighting, marking and signing, airport drainage.

Recommended Books:

Wright Paul H., Dixon Karen, (7th Edition), *Highway Engineering*, John Wiley & Sons, Inc.

Horonjeff Robert, McKelvey, (4th Edition, 1994), *Planning & Design of Airports* McGraw-Hill Book Company.

Federal Aviation Administration (FAA) Guidelines.

83. CE 435: Urban Transportation Planning and Management (2.0 credit hours)

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

Recommended Books:

Papacostas C.S., Prevedouros, (3rd Edition), *Transportation Engineering & Planning*, Prentice-Hall of India.

Wright Paul H., Dixon Karen, (7th Edition), *Highway Engineering*, John Wiley & Sons, Inc.

Documents on Traffic Engineering Administration and Legislation in Courtesy of RHD, LGRD, City Corporation, Planning Commission

84. CE 434: Transportation Engineering Lab II (1.5 credit hours)

Design of flexible and rigid pavement and air field pavements; geometric design; road intersection design and interchanges; traffic studies.

Recommended Books:

As advised by the course teacher.

85. CE 443: Groundwater Engineering (2.0 credit hours)

Groundwater in hydrologic cycle and its occurrence. Physical properties and principles of groundwater movement. Groundwater and well hydraulics. Groundwater resource evaluation. Groundwater levels and environmental influences. Water mining and land subsidence. Groundwater pollution and contaminant transport. Recharge of groundwater. Saline water intrusion in aquifers. Groundwater management.

Recommended Books:

Todd David Keith, *Ground Water Hydrology*.

Herman Bouwer, *Ground Water Hydrology*.

Raghunath H M., *Ground Water Hydrology*.

Uffink J G M., *Ground Water Hydrology*.

86. CE 445: River Engineering (2.0 credit hours)

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 form and flow regimes.

Recommended Books:

Garg Santosh K. (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures*, Khanna Publishers.

Petersen, M.S. (1986). *River Engineering*. Prentice-Hall

Graf, W.H., *Hydraulics of Sediment Transport*, McGraw-Hill.

Grade R.J., RangaRaju K.G., (2nd Edition), *Mechanics of Sediment Transportation & Alluvial Stream Problems*. Wiley Eastern Ltd.

87. CE 447: Hydraulic Structures (2.0 credit hours)

Principles of design hydraulic structures, types of hydraulic structures; design of dams, barrages, weirs, spillways, energy dissipators and spillway gates; cross drainage works.

Recommended Books:

Garg Santosh K. (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures*, Khanna Publishers.

Sharma R.K., *Text Book of Irrigation Engineering & Hydraulics Structures*, Oxford and IBH Publishing, New Delhi.

Different Design Manual/Handbook/Annual Reports of Bangladesh Water Development Board.

88. CE 449: Coastal Engineering (2.0 credit hours)

Coast and coastal features; tides and currents; tidal flow measurement; waves and storm surges; docks and harbours; forces of waves and tides in the design of coastal and harbour structures; coastal sedimentation processes; deltas and estuaries; shore protection works; dredging and dredgers.

Recommended Books:

Sorensen Robert M., *Basic Coastal Engineering*, John Wiley & Sons.

Horikawa K., (1978), *Coastal Engineering an Introduction to Ocean Engineering*, University of Tokyo Press.

Kamphuis J.W., (1999), *Introduction to Coastal Engineering & Management*, World Scientific Publishing.

Dean R.G., and Dalrymple R., (2001), *Coastal Processes with Engineering Applications*, Cambridge University Press.

89. CE 448: Water Resources Engineering Lab (1.5 credit hours)

Design of hydraulic structures, river training works. Ground water resource assessment and water well design.

Recommended Books:

As advised by the course teacher.