

# **Syllabus**

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

**Department of Civil Engineering**

**School of Science and Engineering**

**University of Information Technology & Sciences (UITS)**

**1. Program Name** : Bachelor of Science in Civil Engineering.  
Department of Civil Engineering (CE) 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 2.5 and a minimum 165 credits.

**3. Marks Distribution**

**Theory Courses:**

Class Attendance and Class Participation	10%
Assignment	5%
Class Test	15%
Midterm Examination	20%
Final Examination	50%

**Lab Courses:**

The assessment in laboratory/ field work courses is made by observing the student in the respective lab classes and also by taking viva- voce, quizzes and practical tests.

\*Students specializing in an optional group, such as Structural, Environmental, Geotechnical, Transportation and Water Resources Engineering, shall take Project/Thesis and at least two optional courses and a Corresponding lab course from that group and two more optional courses and another corresponding lab Course from any other group.

\*\*MAT 161 is compulsory for those students whose basic in mathematics is poor (based on Assessment Test).

**4. Semester Wise Distribution**

**1<sup>st</sup> Semester**

CSE 152	Computer Fundamental Applications Lab	1.5
PHY 171	Physical Optics, Waves and Oscillation, Heat and Thermodynamics	3.0
GED 101	The Four Skills of Communication in English I	3.0
GED 102	Developing English Language Skills Lab	1.0
CE 103	Surveying	3.0
CE 102	Civil Engineering Drawing	1.5
GED 105	Bangladesh Studies: History, Culture and Heritage	3.0
<b>Total</b>		<b>16.0</b>

**2<sup>nd</sup> Semester**

EEE 241	Fundamentals of Electrical Engineering	2.0
CE 101	Engineering Mechanics	3.0
MAT 163	Differential and Integral Calculus	3.0
PHY 173	Structures of Matter, Electricity and Magnetism, Modern Physics	3.0
PHY 174	Engineering Physics Lab	1.0
GED 107	Introduction to Sociology	3.0
<b>Total</b>		<b>15.0</b>

**3<sup>rd</sup> Semester**

CE 201	Engineering Materials	3.0
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CE 204	Engineering Materials Lab	1.5
MAT 165	Ordinary and Partial Differential Equation	3.0
CHE 175	Engineering Chemistry	3.0
CHE 176	Engineering Chemistry Lab	1.0
GED 109	Ethics: Theory and Practice	3.0
<b>Total</b>		<b>14.5</b>

#### 4<sup>th</sup> Semester

CE 104	Computer Aided Drafting	1.5
CE 203	Engineering Geology and Geomorphology	3.0
CE 205	Environmental Science	2.0
CE 202	Details of Construction Lab	1.5
CE 251	Mechanics of Solids I (Prerequisite CE 101)	3.0
MAT 167	Coordinate Geometry and Matrix Algebra	3.0
<b>Total</b>		<b>14.0</b>

#### 5<sup>th</sup> Semester

CE 108	Workshop Sessional	1.5
CE 253	Mechanics of Solids II (Prerequisite CE 251)	3.0
CE 206	Quantity Surveying	1.5
CE 208	Structural Mechanics Lab	1.5
CE 241	Fluid Mechanics	3.0
CE 242	Fluid Mechanics Lab	1.5
	Mathematics (any one from optional courses)	3.0
<b>Total</b>		<b>15.0</b>

#### 6<sup>th</sup> Semester

CE 106	Practical Surveying	1.5
MAT 267	Numerical Methods and Analysis	2.0
CSE 252	Computer Programming Lab	1.5
CE 301	Spatial Information System	2.0
CE 304	GIS Lab	1.5
CE 351	Structural Analysis and Design I	3.0
CE 355	Design of Concrete Structures I	3.0
<b>Total</b>		<b>14.5</b>

#### 7<sup>th</sup> Semester

CE 304	Engineering Computation Lab	1.5
CE 311	Water Supply Engineering	3.0
CE 314	Environmental Engineering Lab I	1.5
CE 357	Design of Concrete Structures II	3.0
CE 356	Concrete Structures Design Lab I	1.5
CE 321	Principles of Soil Mechanics (Prerequisite CE 203)	3.0
CE 324	Geotechnical Engineering Lab I	1.5
<b>Total</b>		<b>15.0</b>

**8<sup>th</sup> Semester**

CE 323	Foundation Engineering	3.0
CE 353	Structural Analysis and Design II (Prerequisite CE 351)	3.0
CE 452	Concrete Structures Design Lab II	1.5
CE 331	Transport Planning and Traffic Engineering	3.0
CE 341	Open Channel Flow (Prerequisite CE 241)	3.0
CE 342	Open Channel Flow Lab	1.5
<b>Total</b>		<b>15.0</b>

**9<sup>th</sup> Semester**

CE 359	Design of Steel Structures (Prerequisite CE 351, CE 353)	3.0
CE 360	Steel Structures Design Lab	1.5
CE 313	Waste Water and Sanitation Engineering	3.0
CE 333	Pavement Design and Railways Engineering	3.0
CE 334	Transportation Engineering Lab I	1.5
CE 343	Engineering Hydrology	3.0
<b>Total</b>		<b>15.0</b>

**10<sup>th</sup> Semester**

CE 451	Structural Analysis and Design III	3.0
CE 345	Irrigation Engineering and Flood Management	3.0
CE 315	Building Service	3.0
CE 316	Building Service Lab	1.5
	Civil Engineering Practice (any one)	2.0
CE 490	Project / Thesis	X
<b>Total</b>		<b>12.5</b>

**11<sup>th</sup> Semester**

	Optional	2.0
	Optional	2.0
	Optional	2.0
	Optional	2.0
	Optional	1.5
	Optional	1.5
CE 490	Project / Thesis	X
<b>Total</b>		<b>11.0</b>

**12<sup>th</sup> Semester**

CE 491	Project Planning and Management	3.0
CE 490	Project / Thesis	4.5
<b>Total</b>		<b>7.5</b>
Civil Engineering Practice (Any ONE)		
CE 493	Professional Practices & Communication	2.0

CE 495	Socio-Economic Aspects of Development Project	2.0
CE 497	Integrated Water Resources Planning & Management	2.0

#### Mathematics (Any ONE)

MAT 263	Probability and Statistics	3.0
MAT 269	Complex Variables and Vector Analysis	3.0
MAT 361	Fourier Analysis and Laplace Transforms	3.0

#### Elective Courses (Theory 8.0 cr + Lab 3.0 cr)

Students specializing in an optional group, shall take Project/Thesis and at least two optional courses and a corresponding lab course from that group and two more optional courses and another corresponding lab course from any other group

#### Structural Engineering

CE 453	Introduction to Finite Element Method	2.0
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 Structures	2.0
CE 454	Computer Aided Analysis and Design Sessional	1.5

#### Environmental Engineering

CE 411	Solid and Hazardous Waste Management	2.0
CE 413	Pollution Management	2.0
CE 415	Environmental and Sustainable Management	2.0
CE 414	Environmental Engineering Lab II	1.5

#### Geotechnical Engineering

CE 421	Earth Retaining Structures	2.0
CE 423	Elementary Soil Dynamics	2.0
CE 425	Soil-Water Interaction	2.0
CE 424	Geotechnical Engineering Lab II	1.5
CE 427	Geotechnical-Earthquake Engineering	2.0

#### Transportation Engineering

CE 431	Traffic Planning and Management	2.0
CE 433	Pavement Management, Drainage and Airports	2.0
CE 435	Urban Transportation Planning and Management	2.0
CE 434	Transportation Engineering Lab II	1.5

#### Water Resources Engineering

CE 441	Flood Mitigation and Management	2.0
CE 443	Ground Water Engineering	2.0
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

## **5. Course Details**

### **A. General Education**

#### **1. GED 101 The Four Skills of Communication in English I (3.0 credits)**

Grammatical Problems: Construction of sentences, grammatical errors, sentence variety and style.

Writing: Principle of effective writing, Organization, Planning and Development, Formation of sentence, paragraphs, composition.

Reading: Introduction to the skills of reading, reading short stories, documents, letters with proper emphasis, tone, rhythm, with the addition of reading comprehension.

Phonetics: phonetics and correct English pronunciation.

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

Report writing: Defining a report, Classification of reports, Structure of a report, Writing a report.

#### **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 (1.0 credits)**

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.

#### **3. GED 105 Bangladesh Studies: History, Culture and Heritage (3.0 Credits)**

People of Bangladesh: Origin and Anthropological Identity, Socio-economic History of the British Period. Emergence of Middle Class, Renaissance of Bengal and Contribution of Noted Personalities.

The Pakistan Movement and the Birth of Pakistan, Language Movement, 1948-52, United Front (*Juktafront*) Elections-1954, Six Point Program-1966.

Struggle for Independence and War of Liberation in 1971; Different Sectors of Liberation War and the Birth of Bangladesh.

Political Profile of Bangabandhu Sheikh Mujibur Rahman (1920-1975). Bangabandhu Sheikh MujiburRahman's Great Leadership to the birth of Bangladesh and studying his Unfinished Memoirs. Culture of Bangladesh and Its Basic Characteristics. Urban and Rural Cultural Differences, Sub-cultural Issues. Cultural Conflict.

Folk Culture of Bangladesh and Its Special Features: Their Influence on the Life and Behavior of Common People. Conflict in Folk-Cultures with the Modern One.

#### **Recommended Books:**

Ahmad, Kamruddin. (1975). *A Socio-Political History of Bengal and the Birth of Bangladesh*, 4<sup>th</sup> ed. Dacca: Zahiruddin Mahmud.

IqbalMuhammedZafar, (2008). *History of the Liberation War*, Proteeti, Dhaka, December.

Islam, Sirajul (ed.). (2003). *Banglapedia: National Encyclopedia of Bangladesh*. Dhaka: Asiatic Society of Bangladesh.

Islam, Sirajul. *History of Bangladesh: Social and Cultural History, Political History, Economical History*  
Kamal, Mesbah; Samad, Muhammad and Banu, Nilufar. (2003). *The Santal Community in Bangladesh: Problems and Prospects*. Dhaka: RDC.

Karim, Nazmul. (1956). *Changing Society in India, Pakistan & Bangladesh*. Dhaka;

NawrozeKitabistan;

Rahman. Sheikh Mujibur, (2012). *The Unfinished Memories*, Dhaka: The University Press Limited.

Samad, Muhammad. (2006). "*The Rakhaines In Bangladesh: Ethnic Origin Life And Livelihood*" In *Anthropology On The Move, Edited By Zahidul Islam and Hasan Shafic*. Dhaka: Department Of Anthropology, DU.

Samad, Muhammad. (2007) *A Study on Poverty, Needs and Development Potentials of the Sapuria Community in Bangladesh*. Dhaka: GOB; (Unpublished).

Sarkar, Susobhan. (1970). *Bengal Renaissance and Other Essays*. New Delhi: Peoples Pub. House; জলিল, আলমগীর, (১৯৮৫) *বাংলাদেশের গ্রামীণ সংস্কৃতি*, ঢাকা: ব্র্যাক প্রকাশনা।

রশিদ, হারুন-অর (২০০১) *বাংলাদেশ: রাজনীতি সরকার ও শাসনতান্ত্রিক উন্নয়ন ১৯৫৭-২০০০*, ঢাকা: নিউ এজ পাবলিকেশন।

মামুন, মুনতাসীর; রহমান, মো: মাহবুব; (২০১৩) *স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস*; ঢাকা, সুবর্ণ

সংস্কৃত্যায়ন, রাহুল (১৯৭৩) *মানব সমাজ ( অনুবাদ: সুবোধ চৌধুরী )* ঢাকা: প্রকাশভবন

হালদার, গোপাল (১৯৭৫) *বাঙালী সংস্কৃতির রূপ*, ঢাকা: মুক্তধারা

#### 4. GED 107 Introduction to Sociology (3.0 Credits)

Sociological Concepts: Sociology, Society, Social Change, Family, Religion, Marriage, Norms and Values, Crime and Punishment, Deviance, Understanding Social Situation.

Types of Human Society: Hunting, Fishing, Pastoral Societies. Primitive Societies, Characteristics of Primitive Society, Magic Religion, Food Gathering Society.

Culture and Society: Cultural Diversity, Ethnocentrism, Cultural Lag and Cultural Conflict.

Factors Affecting Social Life: Geography, Heredity, Culture, Group or Social Factors.

Socialization and Class Structure, Classification of Social Stratification, Slavery, Caste, Estate. Theories of Durkheim, August Comte, Karl Marx, Max Weber and Others.

Social Mobility in Urban and Rural Area; Social Control: Concepts, Techniques, Types and Agencies of Social Control.

Ethnicity and Race: Ethnic Group, Minorities and Race in Rural Society; Indigenous and Marginalized Communities in Bangladesh.

#### Recommended Books:

Bottomore. (1964) *Introduction to Sociology*, London: George Allend Unwin.

Giddens, (2005). Anthony. *Sociology*. Cambridge, U.K. Polity Press.

Khan, F. R. (1973) *Principle of Sociology*. Dhaka: Shirin Publications.

Parimal, B. Kar. (1985) *Sociology: The Discipline and Its Dimensions*, Calcutta: New Central Book Agency.

মজিদ, মুসজ্জা, (২০০৭) *গারোজাতিসত্তা*। ঢাকা: মওলাব্রাদার্স।

করিম, নাজমুল, (১৯৮৪) *সমাজবিজ্ঞান সমীক্ষণ*। ঢাকা: নওরোজকিতাববিতান।

#### 5. GED 109 Ethics: Theory and Practice (3.0 Credits)

Group: A

Concept, scope and relevance of studying Ethics to other disciplines: Religion & Spirituality.

Philosophy: objective and functions, utility of philosophy and relationship with Ethics.

Different Branches of Ethics: Normative and Descriptive Ethics; Meta-ethics; Practical Ethics; Environmental Ethics; Medical Ethics; Business Ethics and Professional Ethics.

Actions: Voluntary action, involuntary action, non-voluntary action.

Postulates of moral judgment: Freedom of will, Immortality of the soul and existence of God.

Some theories of moral standard: Utilitarianism, Criticism, Intuitionism, Perfectionism and Evolutionism.

Successful Living: Pessimism, Optimism and Meliorism.

Group: B

Practical perspectives of ethical issues: Equality and its Implications; Animal Liberation; Euthanasia; Rich and Poor; Climate Change; Environment; Civil Disobedience, Violence and Terrorism, Professional Ethics in Civil Engineering.

### Recommended Books:

Ezra, Ovadia. (2006), *Moral Dilemma in Real Life: Current Issues in Applied Ethics*, Springer, The Netherlands.  
Frankena, W.K. (1995), *Ethics*, New Delhi: Prentice-Hall.  
Lillie, W. (1966), *An Introduction to Ethics*, London: Methuen.  
Matin, S. (2006), *An Outline of Philosophy*, Adhuna Prakasan, Dhaka.  
Singer, P. (2011), *Practical Ethics*, Cambridge University Press, Third edition.

### B. Basic Sciences

#### 6. PHY 171 Physical Optics, Waves and Oscillation, Heat and Thermodynamics (3.0 credits)

**Waves and oscillations:** Differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, spring mass system, tensional pendulum; two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, progressive wave, power and intensity of wave, stationary wave, group and phase velocities.

**Optics:** Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Theories of light; Interference of light: Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers; 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, Nicol prism, optical activity, Polarimeters.

**Thermal Physics:** Heat and work- the first law of thermodynamics and its applications; Kinetic Theory of gases- Kinetic interpretation of temperature, specific heats of ideal gases, equipartition of energy, mean free path, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, Thermodynamic functions, Maxwell relations, Clausius and Clapeyron equation.

### 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*.

#### 7. PHY 173 Structure of Matter, Electricity and Magnetism and Modern Physics (3.0 credits)

**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

#### **8. PHY 174 Engineering Physics Lab (1.0 credit)**

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

#### **9. CHE 175 Engineering Chemistry (3.0 credits)**

**States of matter:** Pure Substance and its classification, Mixture, Elements, Compounds, Chemistry of solids, Atomic Structure, Mass number, Isotopes, Isotones and Isobars, Relative atomic mass, Relative molecular mass, Molecule, Mole, Quantum Theory: Bohr's Theory, Heisenberg's Uncertainty principle, Schrodinger equation. Determination of period and group of an element from electronic configuration. Periodic properties, Atomic size, Ionization energy, Electron Affinity, Electronegativity and their variation along period and group. Quantum Number, Use of s, p, d, f to write down the electronic configuration of elements. Transition Elements, Definition of transition elements, Properties of transition Elements, Name and chemical formula of ores of Fe, Cu and Zn. Extraction of Fe, Cu and Zn from their ores. Chemistry of alkali metals, alkaline earth metals and heavy metals. Chemical Bonding, Ionic bonding, Covalent bond, Types of covalent bond, Valence bond theory and molecular orbital theory. Coordinate covalent bond, Indication of types of bond present in molecule. Metallic bonding, Electron Gas Theory of metallic bonding, Properties of metallic bonding, H-bonding: Definition, classification, Significance and properties, Bonding in graphite and diamond, Van der Waals force of interaction and its types. Acids and Bases, Arrhenious definition of acid and base, Bronsted Lowry definition of acid and base, The Conjugate acid- base pair, Lewis acids and bases, Strong and weak acids, Strength of acids. Chemical Equilibrium and acid base equilibrium, Acid dissociation constant, pH, Buffer solution , Henderson Equation. Thermochemistry, Enthalpy and enthalpy change, Exothermic and Endothermic reaction, Enthalpy of formation. Enthalpy of neutralization, Enthalpy of combustion, Hess's law of heat summation. Chemical Kinetics, Rate, order and molecularity of a chemical reaction, Factors affecting the rate of chemical reaction. Redox reaction, Understand oxidation and reduction, oxidizing and reducing agents in terms of electron transfer. Electrochemistry, Ionichalf cell equations, voltaic cell, emf of the cell, electrochemical process in batteries, corrosion, electrolysis electrolytic cell and its application in electroplating and galvanizing, Rusting. Solution chemistry, Phase diagram, composition of different solutions.

#### **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.

#### **10. CHE 176 Engineering Chemistry Lab (1.0 credit)**

Volumetric analysis: acid-base titration, oxidation-reduction titrations, pH titrations.

## C. Mathematics

### 11. MAT 163 Differentials and Integral Calculus (3.0 credits)

Differential Calculus: Differential Calculus: Limits, continuity and differentiability; Successive differentiation of various types of functions; Leibnitz's Theorem; Rolle's Theorem; Mean value theorem in finite and infinite forms; Lagrange's form of remainders; Cauchy's form of remainder; Evaluation of indeterminate forms by L'Hopital's rule; Partial differentiation; Euler's Theorem; Maximum and minimum values of functions of single variable.

Integral Calculus : Definition of integration; Integration by the method of substitutions; Integration by parts; Standard integrals; Integration by the method of successive reduction; Definite integrals and its properties and use in summing series; Wallis' formula, improper integrals. Beta function and Gamma function; Trapezoidal rule, Simpson's rule, Jacobian, multiple integrals and its application.

#### Recommended Books:

Anton, H., Bivens, I., & Davis, S. (2005). *Calculus*. John Wiley & Sons.  
Das, B.C. & Mukharjee, B. N. (1949). *Differential Calculus*.  
Das, B.C. & Mukharjee, B. N. (1998). *Integral Calculus*. U N Dhur.

### 12. MAT 165 Ordinary and Partial Differential Equations (3.0 credits)

Degree and order of ordinary differential equations, Formation of differential equations, Solution of first order differential equations by various methods, Solution of first order but higher degree ordinary differential equations, Solution of general linear equations of second and higher orders with constant coefficients, Solution of homogeneous linear equations and its applications.

#### Recommended Books:

Ross, S. L. (1989). *Differential equations*. John Wiley & 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.

### 13. MAT 167 Coordinate Geometry and Matrix Algebra (3.0 credits)

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.

Definition of matrices. Algebra of matrices. Transpose of a matrix and inverse of matrix. Factorization. Determinants. Quadratic forms. Matrix polynomials. Introduction to systems of linear equations. Solution of systems of linear equations : Gaussian elimination method. Gauss – Jordan Elimination method, Inversion of matrices, Euclidean n-space. Linear transformation from  $R^n$  to  $R^m$ . Properties of linear transformation from  $R^n$  to  $R^m$ . Real vector spaces and subspaces. Basis and dimension. Rank and nullity. Inner product spaces. Eigenvalues and eigenvectors. Diagonalization. Linear transformations. Kernel and Range. Application of linear algebra to electric networks.

#### 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.

### 14. MAT 267 Numerical Methods and Analysis (2.0 credits)

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.

**15. MAT 263 Probability and Statistics (3.0 credits)**

Statistics: Frequency distribution of data: Population and sample, Collection and representation of statistical data. Tabulation of data. Class intervals. Frequency distribution, discrete, continuous and cumulative distributions. Histograms and frequency polygons. Graphical representation of data.

Statistical Measures: Measures of central tendency – arithmetic mean, median, mode, geometric mean, weighted average, harmonic mean. Measures of dispersion – range, standard deviation, variance, coefficient of variation, moments, skewness, kurtosis. Correlation theory: Linear correlation, Measures of correlation and its significance. Regression and curve fitting: Linear and non-linear regression, Methods of least squares. Curve fitting. Time series analysis.

Probability: Definition of probability and related concepts. Laws of probability, Discrete and continuous random variables, Mathematical expectations. Conditional probability. Probability distributions: Binomial, Poisson and Normal distributions and their properties. Stochastic process: Markov chain - discrete and continuous.

**Recommended Books:**

Islam, M. N. *An Introduction to probability & Statistics*. Mullick and Brothers.  
Gupta, S.P & Gupta, M.P. *Business Statistics*. New Age International.  
Roy, M.K. *Fundamentals of Probability and probability distributions*. Croxton & Cowdon. by M. Nurul Islam. An Introduction to probability & Statistics

**16. MAT 269 Complex Variables and Vector Analysis (3.0 credits)**

Complex Variable: Complex number system. General functions of a complex variable. Limits and continuity of a function of complex variable and related theorems. Complex differentiation and the Cauchy-Riemann equations. Infinite series. Convergence and uniform convergence. Line integral of a complex function. Cauchy's integral formula. Liouville's theorem. Taylor's and Laurent's theorem. Singular points. Residue. Cauchy's residue theorem.

Vector Algebra: Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Scalar and vector product of two vectors and their geometrical interpretation; Triple products and multiple products. Linear dependence and independence of vectors.

Vector Calculus: Differentiation and integration of vectors together with elementary applications. Line, surface, and volume integrals. Gradient of a scalar function, divergence and curl of a vector function, various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

**Recommended Books:**

Spiegel, M., & Lipschutz, S. (2009). *Schaum's Outline of Complex Variable*. McGraw Hill Professional.  
Brown, J., & Churchill, W. R. V. (1996). *Complex Variable and Applications*. McGraw-Hill.  
Rahman, A.F.M., & Bhattacharjee, P.K. (2005). *A Text Book of co-ordinate Geometry with Vector Analysis*. S. Chakroborty.

**17. MAT 361 Fourier Analysis & Laplace Transforms (3.0 credits)**

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. MAT 161 Fundamental Mathematics (3.0 credits)**

Fundamental concepts of algebra, Real numbers, Exponents, Radicals, Algebraic and functional expressions, Equations: Linear and Quadratic, Complex numbers, Inequalities, Graphs of equations, Lines: Parallel and perpendicular, Exponential and logarithmic functions, Sets, counting and probability. Matrices and Systems of Equations, Determinants, Vector space, Matrix multiplication, Transpose, Square matrices, Diagonal and trace, Matrix inversion, Partial Fraction, Binomial Theorem, Summation notation. Trigonometric functions, values of trigonometric functions, Trigonometric identities and equations, Tangents. Computation of derivatives, The product and quotient rules, Derivatives of Trigonometric, logarithmic and exponential functions, The Chain Rule, Integration review, including Fundamental Theorem of Calculus, Indefinite integrals, Definite integrals, Introduction to area under the curves. (Prerequisite: None)

**Recommended Books:**

Swokowski, E.W., & Cole, J.A. *Algebra and Trigonometry with analytic geometry*  
Hoffman, L. D. *Finite Mathematics with calculus*.  
Yee, L. P. *Pure Mathematics*  
Das, B.C. & Mukharjee, B. N. *Integral Calculus*.  
Das, B.C. & Mukharjee, B. N. *Differential Calculus*.

**D. Engineering (Basic)****19. CSE 152 Computer Fundamental Applications Lab (1.5 Credits)**

The fundamental computing concepts including data presentation, the binary system, the system unit, memory, storage systems, input devices, output devices, systems software. Key Applications include MS Word, Excel, PowerPoint and Access, Internet, e-mail and the impact of computers on society.

**Recommended Books:**

Parsons, J. J. & Oja, D. (2005). *Practical Computer Literacy [With Accompanying CD]*. Boston: Course Technology of Thomson Learning. ISBN: 0-619-21389-2.  
Norton Peter, *Introduction to Computers*.  
Williams / Sawyer, (A practical introduction to computers and communications) *Using Information Technology*.  
O'Leary Timothy J., O'Leary Linda I., *Computer Today*.  
Ray Deborah, S., Ray Eric J., *Mastering HTML*.  
Dietel H.M., Dietel P.J., Nieto T.R., *Internet and Worldwide Web*.

**20. CE 101 Engineering Mechanics (3.0 credits)**

Introduction to SI units, 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.

**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.

**21. CE 103 Surveying (3.0 credits)**

Reconnaissance survey; linear measurements; traverse survey; leveling and contouring; calculation of areas and volumes; problems on heights and distances; curves and curve ranging: transition curve, vertical curves;

Tacheometry: introduction, principles and problems on Tacheometry. Introduction of Astronomical surveying, Photogrammetry, introduction of terrestrial photography, aerial photography, reading of photo mosaic, scale; project surveying; errors in surveying.

**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.

**22. CE 201 Engineering Materials (3.0 credits)**

Properties and uses of bricks, efflorescence, cement, cement chemistry, aggregates, cement and lime mortars, concrete, standard tests of bricks, cement and concrete, salinity problem in concrete, corrosion and its prevention, paints, varnishes metallic coating. Design of concrete mixes, atomic structure and bonding, crystal structures, mechanical properties, yielding, fracture, elasticity, plasticity, properties and uses of rubber, timber and plastics, concrete for special purposes, ferrocement; advanced fiber reinforced polymer (FRP) composites and its application to civil engineering; reinforcement types, basic property of FRP composites and available FRP composite products.

**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

**23. CE 203 Engineering Geology and Geomorphology (3.0 credits)**

Physical Geology: Interior of the earth and geological timescale, plate tectonics, classification of minerals and rocks, weathering process and sedimentation. Soil forming process, geology of Bangladesh, geo-resources of Bangladesh.

Structural geology: classification of faults, classification of old, unconformity and joints, domes, basins, erosional process, quantitative analysis of erosional land forms, landslide, earthquake and seismic map of Bangladesh, hydrocarbon reservoir and traps, structural geology and natural resources.

Geomorphology and Environment: Concept of geomorphology, relationship of geology and geomorphology, geomorphologic environment-alluvial, fluvial and coastal landforms, geomorphology for engineering geological mapping, significance of geomorphology and engineering geology in planning and development, 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.  
Singh Prabin, *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*, New York.

**24. CE 205 Environmental Science (2.0 credits)**

Introduction to Environmental Science, Population and Environment, Fundamentals of Ecology, Biodiversity and Conservation, Air Pollution and Climate Change, Water Pollution and Prevention, Water Resource Management, Natural Hazards and Disaster Management, Pollution and Waste Management, Environmental Health and Sanitation, Alternative energy sources, Sustainable development.

**Recommended Books:**

Environmental Science: Earth as a Living Planet by Daniel B. Botkin (Author), Edward A. Keller (Author)

## 25. CE 251 Mechanics of Solids I (3.0 credits)

Fundamental concepts of stress and strain. Mechanical properties of materials, strain energy, stresses and strains in members subjected to tension, compression, shear and temperature changes, bending moment and shear force diagrams of beams and frames, flexural and shearing stresses in beams, shear centre, thin walled pressure containers, riveted and welded joints.

### Recommended Books:

Popov Egor. P., *Engineering Mechanics of Solids*, Prentice-Hall of India.  
Pytel Andrew, Singer Ferdinand L. (4<sup>th</sup> 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.

## 26. CE 253 Mechanics of Solids II (3.0 credits)

Torsional stresses in shafts and tubes, compound stresses, helical springs, transformation of stresses, deflection of beams by direct integration, moment area, elastic load and conjugate beam methods, buckling of columns.

### Recommended Books

Popov Egor. P., *Engineering Mechanics of Solids*, Prentice-Hall of India.  
Pytel Andrew, Singer Ferdinand L. (4<sup>th</sup> 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.

## 27. CE 241 Fluid Mechanics (3.0 credits)

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, (1<sup>st</sup> SI Edition), *Fluid Mechanics*, McGraw-Hill Book Company.  
Street Robert, Watters G. Z., Vennard J.K., (7<sup>th</sup> Edition), *Elementary Fluid Mechanics*, John Wiley & Sons.  
Som and Biswas, *Introduction to Fluid Mechanics and Machines*, Tata McGraw-Hill Publisher.

## 28. CSE 252 Computer Programming Lab (1.5 Credits)

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.  
Visual Studio 6.0

### Recommended Books:

Kochan Stephen, (3rd Edition), *Programming in C*, Developer's Library, Paperback - Jul 8, 2004.  
Kernighan Brian W., Ritchie Dennis, (2nd Edition), *The C 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*.

### **29. EEE 241 Fundamentals of Electrical Engineering (2.0 Credits)**

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.

### **30. CE 102 Civil Engineering Drawing (1.5 credits)**

Introduction – Lines and lettering; Plane geometry: drawing of linear and curved geometric figures, e.g., pentagon, hexagon, octagon, ellipse, parabola, hyperbola. Solid geometry: Projections of cube, prism, cone, cylinder; developments, true shapes and section of cube, pyramid, cone, prism; isometric and oblique drawings of cube, pyramid, cone. Plan, elevations and sections of one storied buildings and bridges.

#### **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 credits)**

Introduction to CAD packages and computer aided drafting; drawing editing and dimensioning of simple objects. Plan, elevations and sections of multi-storied buildings; reinforcements 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; Building services drawings.

#### **Recommended Books:**

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

### **32. CE 106 Practical Surveying (1.5 credits)**

Three (3) weeks of field work.

### **33. CE 108 Workshop Sessional (1.5 credits)**

#### 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.

### **34. CE 202 Details of Construction Lab (1.5 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.

#### **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.

### **35. CE 204 Engineering Materials Lab (1.5 credits)**

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.

### **36. CE 206 Quantity Surveying (1.5 credits)**

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.

### **37. CE 208 Structural Mechanics Lab (1.5 credits)**

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.



### **38. CE 242 Fluid Mechanics Lab (1.5 credits)**

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.

### **39. CE 304 Engineering Computation Lab (1.5 credits)**

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.

### **40. CE 301 Spatial Information System (2.0 credits)**

Spatial Information and Engineering: Concepts, Background and Importance, History of Mapping and Map Applications; Introduction, Background, and Scope of Geographic Information Science (GIS), Spatial Data Format, Structure, and Design, Coordinate system and Understanding Map Projection, Geoprocessing and Spatial Analysis, Application of GIS in Engineering and Environmental Modeling; Basics of GPS and GPS Data Applications; Scope, Concepts and Foundations of Remote Sensing, Satellite Remote Sensing-Satellites and Sensor Characteristics, Remote Sensing Data Acquisition and Interpretation, Remote Sensing Data Processing and Analyses, Application of Remote Sensing

#### **Recommended Books:**

Chang, Kang-tsung. 2010. Introduction to Geographic Information Systems, 5th ed., McGraw-Hill Higher Education, Toronto.

Burrough, Peter A., and Rachael A. McDonnell. 1998. Principles of Geographical Information Systems, Oxford University Press, Toronto.

Fundamentals of Remote Sensing, *Canada Centre for Remote Sensing*

### **41. CE 302 GIS Lab (1.5 credits)**

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

## **E. Structural Engineering**

### **42. CE 351 Structural Analysis and Design I (3.0 Credits)**

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:**

Shedd T. C. & Vawter J. (2<sup>nd</sup> Edition), *Theory of Simple Structures*, John Wiley & Sons, Inc.

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

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

### **43. CE 353 Structural Analysis and Design II (3.0 Credits)**

Wind and earthquake loads; approximate analysis of 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. (2<sup>nd</sup> Edition), *Theory of Simple Structures*, John Wiley & Sons, Inc.  
Norris Charles, Wilbur J. & Utku Senol (4<sup>th</sup> Edition), *Elementary Structural Analysis*, McGraw-Hill Int'l Edition.  
Timoshenko S., *Theory of Structure*, CBS Publishers & Distributors.

**44. CE 355 Design of Concrete Structures I (3.0 Credits)**

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, (7<sup>th</sup> Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.  
*Design of Concrete Structure* (13<sup>th</sup> Edition)- (McGraw-Hill Higher Education)  
Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6<sup>th</sup> 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 357 Design of Concrete Structures II (3.0 Credits)**

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, (7<sup>th</sup> Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.  
*Design of Concrete Structure* (13<sup>th</sup> Edition)- (McGraw-Hill Higher Education)  
Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6<sup>th</sup> 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.

**46. CE 359 Design of Steel Structures (3.00 credits)**

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.

**47. CE 451 Structural Analysis and Design III (3.0 Credits)**

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, (2<sup>nd</sup> Edition), *Matrix Analysis of Framed Structures*, CBS Publishers & Distributors.

Norris Charles, Wilbur J. & Utku Senol, (4<sup>th</sup> 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.

#### **48. CE 360 Steel Structures Design Lab (1.5 Credits)**

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.

#### **49. CE 356 Concrete Structures Design Lab I (1.5 Credits)**

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.

##### **Recommended Books:**

AASHTO Bridge Design Manual 2002

Winter George, Nilson, (10<sup>th</sup> Edition), *Design of Concrete Structures*, McGraw-Hill Higher Education.

Raju N. Krishana, *Design of Bridges*, Oxford & IBH Publishing Co, New Delhi.

#### **50. CE 452 Concrete Structures Design Lab II (1.5 Credits)**

Design of various reinforced concrete structures, e.g. cantilever bridge and multistoried building.

##### **Recommended Books:**

Different Manuals From AISC/AREA can be used as guideline

### **F. Environmental Engineering**

#### **51. CE 311 Water Supply Engineering (3.0 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 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 treatment – plain sedimentation, flocculation and coagulation, filtration, disinfection; miscellaneous treatment methods; low cost treatment methods for rural communities.

##### **Recommended Books:**

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

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

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

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

#### **52. CE 313 Waste Water and Sanitation Engineering (3.0 credits)**

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, (2<sup>nd</sup> 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'1 Edition.  
Hammer Mark J. (4<sup>th</sup> Edition), *Water & Waste Water Treatment*, Prentice-Hall of India Pvt. Ltd.  
Metcalf & Eddy, (3<sup>rd</sup> 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.

**53. CE 314 Environmental Engineering Lab I (1.5 credits)**

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. (4<sup>th</sup> Edition), *Water & Waste Water Treatment*, Prentice-Hall of India Pvt. Ltd.

**54. CE 315 Building Service (3.0 credits)**

Introduction to plumbing, water requirements in a building, water supply and distribution in buildings; plumbing of multistoried buildings, design and construction of septic tanks, soak wells and subsurface drain fields; House wiring; air conditioning (HVAC); lift installation; air handling unit, generator and other electrical and mechanical installations in building, rain water harvesting unit, solar panel, fire-fighting, fire escape.

**Recommended Books:**

Building services handbook by Fred hall and Roger Greeno  
Building service engineering by David V. Chadderton  
Building Services, Technology and Design by Roger Greeno

**55. CE 316 Building Service Lab (1.5 credits)**

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.

**G. Geotechnical Engineering**

**56. CE 321 Principles of Soil Mechanics (3.0 credits)**

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, (2<sup>nd</sup> Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.

Das B. M. (6<sup>th</sup> Edition), *Principles of Geotechnical Engineering*, Thomson Brooks/Cole.  
Codute Donald P., *Geotechnical Engineering-Principles & Practice*, Prentice-Hall of India.  
Punmia B. C. (13<sup>th</sup> Edition), *Soil Mechanics & Foundation*, Laxmi Publication, New Delhi.

### **57. CE 323 Foundation Engineering (3.0 credits)**

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, (2<sup>nd</sup> 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. (13<sup>th</sup> Edition), *Soil Mechanics & Foundation*, Laxmi Publication, New Delhi.  
Scott C. R., (3<sup>rd</sup> 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.

### **58. CE 324 Geotechnical Engineering Lab I (1.5 credits)**

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**

### **59. CE 331 Transportation Planning and Traffic Engineering (3.0 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.

#### **Recommended Books:**

Rangwala, (14<sup>th</sup> Edition), *Principles of Railway Engineering*, Charter Publishing House, India.  
Wright Paul H., Dixon Karen, (7<sup>th</sup> 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*.

### **60. CE 333 Pavement Design and Railway Engineering (3.0 credits)**

Highways materials; sub-grade, sub-base and base courses; soil stabilization and soil aggregates in road constructions; low-cost roads; production, properties and uses of bituminous materials and mix design methods; design, construction and maintenance of flexible and rigid road pavements; equipments; railways:

general requirements, alignment, permanent way, station and yards, signaling, points and crossings, maintenance.

**Recommended Books:**

Wright Paul H., Dixon Karen, (7<sup>th</sup> Edition), *Highway Engineering*, John Wiley & Sons, Inc.  
Papacostas C. S., Prevedouros P. D., (3<sup>rd</sup> Edition) *Transportation Engineering & Planning*, Prentice-Hall of India.  
Kadiyali L. R., (2<sup>nd</sup> Edition), *Traffic Engineering & Transportation Planning*, Khanna Publishers.  
KhistryJotin, Lal Kent, (3<sup>rd</sup> 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.

**61. CE 334 Transportation Engineering Lab I (1.5 credits)**

Tests of bituminous materials, tests on sub-grade, sub-base and base materials; mix design methods; bituminous mix design; roadway capacity analysis; application of analytical, simulation and statistical packages.

**I. Water Resources Engineering**

**62. CE 341 Open Channel Flow (3.0 credits)**

Open channel flow and its classification, Velocity and its pressure distributions, Energy equation, specific energy and transition problems.  
Critical flow and control. Principle of flow measurement and devices. Concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow. Momentum equation and specific momentum. Hydraulic jump. Theory and analysis of gradually varied flow. Computation of flow profiles.

**Recommended Books:**

Chow VenTe, (1959), *Open Channel Hydraulics*, McGraw-Hill Book Company.  
RangaRaju K. G., *Flow Through Open Channels*, Tata McGraw-Hill Publisher, India.

**63. CE 343 Engineering Hydrology (3.0 credits)**

Hydrologic cycle. Weather and hydrology. Precipitation, Evaporation and Transpiration. Infiltration. Stream flow. Rainfall-runoff relations. Hydrographs, unit hydrographs. Hydrologic routing. Statistical methods in hydrology, Science of Hydrogeology.

**Recommended Books:**

ChowV. T., Maidment David R, Larry, *Applied Hydrology*, McGraw-Hill Book Company.  
Subramanya K., (2<sup>nd</sup> Edition), *Engineering Hydrology*, Tata McGraw-Hill Publisher, India.

**64. CE 345 Irrigation Engineering and Flood Management (3.0 credits)**

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 channels, Design of irrigation canal system. Irrigation structures, Irrigation Pumps, Problems of irrigated lands, Floods and its Management.

**Recommended Books:**

GargSantosh K., (17<sup>th</sup> 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.

#### **65. CE 342 Open Channel Flow Lab (1.5 credits)**

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.

#### **J. Civil Engineering Practice**

#### **66. CE 491 Project Planning and Management (3.0 credits)**

Principles of management; principles of construction management; construction contracts and specifications; inspection and quality control; construction safety; construction planning and scheduling : PERT, CPM, case studies, resource scheduling; PERT : a cost accounting system, linear programming. Psychology in administration; materials management; demand forecasting; inventory control; stores management; procurement. Project planning and evaluation; feasibility reports, cash flow, payback period, internal rate of return. Benefit-cost ratio, construction equipments and plants. Replacement studies.

#### **Recommended Books:**

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

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

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

#### **67. CE 493 Professional Practices and Communication (2.0 credits)**

The project cycle; project proposal; contractual provisions; techniques of specification writing; evaluation of bids; project evaluation. Interpretation of literature, documents, etc.; communication; preparation of reports; industrial and labour relations; professional ethics in civil engineering.

#### **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

#### **68. CE 495 Socio – Economic Aspects of Development Projects (2.0 credits)**

Economic and social structure; development and economic growth; socio-economic indicators; population, prosperity and poverty; employment of workforce; population displacement; 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 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/>

### **69. CE 497 Integrated Water Resources Planning and Management (2.0 credits)**

Basic concepts in integrated water resources management. Economic, environmental and institutional aspects. Participation of beneficiaries. Formation of users' group. Fisheries management. Strategic planning. System analysis approach. Conceptual framework and models. Analytical techniques. Operation and maintenance of water resources systems.

#### **Recommended Books:**

Goodman Alvin S, *Principles of water resource planning*.  
Helweg Otto J., *Water resource planning and management*.  
Mays Larry W., *Water resource management*.

### **K. Optional Courses**

### **70. CE 453 Introduction to Finite Element Method (2.0 credits)**

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

#### **Recommended Books:**

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

### **71. CE 455 Prestressed Concrete (2.0 credits)**

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

#### **Recommended Books:**

Lin T. Y., Burns Ned H, (3<sup>rd</sup> Edition), *Prestressed Concrete*.

### **72. CE 457 Design of Concrete Structures III (2.0 Credits)**

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:**

Lin T. Y., Burns Ned H, (3<sup>rd</sup> Edition), *Prestressed Concrete*, John Wiley & Sons, Inc.  
Winter George, Rourke O', Nilson, (7<sup>th</sup> Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.  
*Design of Concrete Structure* (13<sup>th</sup> Edition)- (McGraw-Hill Higher Education)  
Nilson, Drawing, Dolan Charles, Wang Chukia & Salmon Charles G. (6<sup>th</sup> Edition), *Reinforced Concrete Design*, John Wiley & Sons.  
Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education  
Limbrunner George F. & Spigell Leonard, *Reinforced Concrete Design*, Prentice – Hall of India Pvt. Ltd.

### **73. CE 459 Dynamics of Structures (2.0 credits)**

Formulation of equation of motion; free vibration response; SDOF and MDOF systems; response to harmonic and impulse loading and vibration analysis by Rayleigh's method.

#### **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,



#### **74. CE 461 Introduction to Steel-Concrete Composite Structures (2.0 credits)**

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

#### **75. CE 454 Computer Aided Analysis and Design Sessional (1.5 credits)**

Computer aided analysis and design of structures: Use of structural analysis and design software; design of various reinforced concrete structures, e.g. building, water tower, folded plate roof.

#### **76. CE 411 Solid and Hazardous Waste Management (2.0 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.

##### **Recommended Books:**

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

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

#### **77. CE 413 Pollution Management (2.0 credits)**

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.

##### **Recommended Books:**

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

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

#### **78. CE 415 Environmental and Sustainable Management (2.0 credits)**

Environment and development projects; environment and sustainable development; environmental politics and legislation; environmental implication of sectoral development; environmental quality standards; environmental issues and priorities; environmental impact assessment of development schemes – baseline studies, assessments methodologies; economics of environmental management; special topics.

##### **Recommended Books:**

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

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

#### **79. CE 414 Environmental Engineering Lab II (1.5 credits)**

Design of water supply and sewage system; design of water and wastewater treatment plant; computer application in environmental engineering; field visits and reporting.

### **80. CE 421 Earth Retaining Structures(2.0 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, caissons; machine foundations – elementary vibrations, shear modulus and elastic constants, foundation design for vibration, fundamental of soil liquefaction.

#### **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., (6<sup>th</sup> Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

### **81. CE 423 Elementary Soil Dynamics (2.0 credits)**

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

#### **Recommended Books:**

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

Punmia B.C., (13<sup>th</sup> 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., (6<sup>th</sup> Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

### **82. CE 425 Soil-Water Interaction (2.0 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 designs; hydraulic fills.

#### **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., (6<sup>th</sup> Edition), *Principles of Geotechnical Engg.*, Thomson Books/Cole.

### **83. CE 427 Geotechnical-Earthquake Engineering (2.0 credits)**

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, (2<sup>nd</sup> 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.

### **84. CE 424 Geotechnical Engineering Lab II (1.5 credits)**

Computer aided design of foundations, retaining walls and reinforced soils, slope stability analysis, techniques of soil improvement, use of computer in geotechnical engineering.

### **85. CE 431 Traffic Planning and Management (2.0 credits)**

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, (7<sup>th</sup> Edition), *Highway Engineering*, John Wiley & Sons, Inc.  
Kadiyali L.R., (2<sup>nd</sup> 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)

### **86. CE 433 Pavement Management, Drainage and Airports (2.0 credits)**

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

#### **Recommended Books:**

Wright Paul H., Dixon Karen, (7<sup>th</sup> Edition), *Highway Engineering*, John Wiley & Sons, Inc.  
Horonjeff Robert, McKelvey, (4<sup>th</sup> Edition, 1994), *Planning & Design of Airports* McGraw-Hill Book Company.  
Federal Aviation Administration (FAA) Guidelines.

### **87. CE 435 Urban Transportation Planning and Management (2.0 credits)**

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, (3<sup>rd</sup> Edition), *Transportation Engineering & Planning*, Prentice-Hall of India.  
Wright Paul H., Dixon Karen, (7<sup>th</sup> Edition), *Highway Engineering*, John Wiley & Sons, Inc.  
Documents on Traffic Engineering Administration and Legislation in Courtesy of RHD, LGRD, City Corporation, Planning Commission

### **88. CE 434 Transportation Engineering Lab II (1.5 credits)**

Design of rigid and flexible highway and air field pavements; geometric design: road intersections and interchanges; capacity calculations; traffic studies and design.

### **89. CE 441 Flood Mitigation and Management (2.0 credits)**

Flood and its causes. Methods of flood management: structural and non-structural measures such as reservoirs, levees and flood walls, channel improvement, interior drainage, floodways, land management, flood proofing, flood zoning, flood hazard mapping, flood forecasting and warning.

#### **Recommended Books:**

Ghosh S. N., *Flood Control & Drainage*.  
Ahmed Mohiuddin, *Flood in Bangladesh*.

### **90. CE 443 Groundwater Engineering (2.0 credits)**

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:**

ToddDavid Keith, Ground Water Hydrology.  
HermanBouwer, Ground Water Hydrology.  
RaghunathH M., Ground Water Hydrology.  
UffinkJ G M., Ground Water Hydrology.

**91. CE 445 River Engineering (2.0 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.

**Recommended Books:**

GargSantosh K. (17<sup>th</sup> 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., RangaRajuK.G., (2<sup>nd</sup> Edition), *Mechanics of Sediment Transportation & Alluvial Stream Problems*.Wiley Eastern Ltd.

**92. CE 447 Hydraulic Structures (2.0 credits)**

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

**Recommended Books:**

GargSantosh K. (17<sup>th</sup> 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.

**93. CE 449 Coastal Engineering (2.0 credits)**

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

**94. CE 448 Water Resources Engineering Lab (1.5 credits)**

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