Z. H. Sikder University of Science & Technology

Department of Civil Engineering

Course Curriculum For

B.Sc. in Civil Engineering

Faculty of Engineering

Program Name: B.Sc. in Civil Engineering

Awarded Degree:

Full Name : Bachelor of Science in Civil Engineering

Abbreviation : BSCE

Organizer: Department of Civil Engineering, Faculty of Engineering

Mission and Vision of the Department

Mission:

The mission of this Department is to offer a Civil Engineering undergraduate program that augments the liberal education expected of all undergraduates and impart a basic understanding of Civil Engineering built on a foundation of physical science, mathematics, computing, and technology. Graduates of the undergraduate program are expected to possess knowledge of the fundamentals of Civil Engineering and of at least one specialty area. The graduates are expected to have the basic experimental, design, and communication skills to be prepared for continued study at the graduate level or for entry level positions that require a basic knowledge of Civil Engineering, science, and technology.

Vision:

The vision of the Department by the University is to develop through this a center of excellence in learning and practice, and this to serve the country by leadership, knowledge, and technology.

Objectives of BSCE Program

1. Enables the individual to contribute to the field of construction and infrastructure development.
2. Makes the graduates to take the responsibility of the environment to foster for development of housing and standard of living.
3. To give the graduates the necessary communication skills and the ability to use new technologies to develop themselves to move with the rapidly innovative world.
4. To produce highly skilled and morally sensitive professional leadership in the country.

Admission Requirements

A candidate having at least 12-year schooling from relevant discipline can apply for undergraduate admission, if she/he can satisfy any of the following conditions:

- S/he has a minimum GPA of 2.5 at both S.S.C and H.S.C levels.
- S/he has a GPA of less than 2.5 at S.S.C or H.S.C level, but the combined GPA at both levels is at least 6.0.
- S/he is a ward of freedom fighter(s), and the combined GPA at S.S.C and H.S.C levels is at least 5.0.
- S/he has a minimum GPA of 2.5 in four subjects at "O" level and 2.5 in two subjects at "A" level in the scale of A=5, B=4, C=3, D=2, and E=1.
- S/he will have to complete Basic Mathematics as non credits Course in first semester; if he/she didn't have mathematics in his/her H.S.C program.
- A student only from science group in H.S.C/equivalent program will be eligible for admission.

Length of the Program

Normally a student in undergraduate program completes his/her program in 6-8 bi-semesters or in a time period of 3-4 years. However, an undergraduate student must complete his/her program in a maximum period of 6 (six) years. The minimum course load for Civil Engineering student is 16 credits hours and the maximum is 24 credits hours in a semester.

Degree/ Graduation Requirements

A student with 12 years formal pre-University education (i.e. S.S.C. + H.S.C. or its equivalent) must earn a total of 160.0 credits including internship/dissertation/project. A minimum GPA for graduation is 2.50 on a scale of 4.00 or any uniform system prescribed by the UGC. A student failing in any compulsory course will have to repeat the course.

The University follows the American System of Evaluation and Assessment prevalent in most North American universities and considers exemptions for prior credits earned by candidates beyond 12 years of education. Since, students with Diploma degree, under the Bangladesh Technical Education Board (BTEB) or any other similar body, have completed a year or more in addition to 12 years of the pre-university education and possess the technical and work based knowledge, they will require completing 140.0 credits for the B.Sc. in CE degree. Thus, the students will have the option of completing the degree program in less than four years time.

Performance Evaluation

The performance of a student will be evaluated on the basis of Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), which is the grade point average of all semester. Student will be considered making normal progress towards the degree if their GPA is 2.50 or more. The students who fail to maintain this minimum GPA will not be awarded the degree. A student can retake any exam with payment of prescribed fees.

Academic Year

Each Academic Year is divided into 2 semesters (Spring & Fall). Classes are held within 16 weeks of a semester and 4 weeks are allocated for Examination. In each semester, there will be 3 periods @ 50 minutes per week for a 3 credits theory course, 4 periods @ 50 minutes per week for 4 credits theory course, and 2 periods @ 50 minutes per week for 2 credits theory course. For Sessional / Practical /Laboratory/Design class, there will be 1 period @ 150 minutes per week for a 1.5 credits Laboratory course.

Waiver of Courses

Students with excellent academic records and/or extensive professional experience may apply to the Dean of the Faculty or the Advisor of the program along with the latest academic transcripts issued by the previous institutions for course waiver. A student who has completed the same or advanced course and got the letter grade of 'B' or higher from the institution which follows the grading policy of UGC of Bangladesh may get the course waiver from the current program. However, the letter grade 'C' can also be considered for course waiver if the highest letter grade 'A' or 'A+' of the institution is based on 90% or higher marks. Under all circumstances, university authority reserves the right to accept or refuse the student's appeal for course waiver.

Credit Transfer

The student, native or foreign, willing to transfer his/her credits from other accredited institutions must fulfill the general admission requirements for the specific program. The student must write an application for credit transfer to the Registrar along with the Official Academic Transcripts issued by the previous institutions and NOC (no objection certificate). Under no circumstances, can a student transfer more than 50% credits from other institutions.

The student willing to transfer his/her credits from here to other institutions in Bangladesh or abroad must write an application to the Registrar along with the papers issued by the institution s/he is willing to study. The student may again come back and study. S/he can also attend classes in a trimester but s/he has to register for courses as special or non-degree student.

Withdrawal

A student willing to withdraw from all courses before the end of the second week from the class commencement date in each bi-semester must write an application and submit it to the Office of the Registrar. The date on which the Registrar signs the withdrawal form is considered the official withdrawal date. A student who leaves the university without officially withdrawing in this manner receives a failing grade (F) in each course.

A student is not eligible for any adjustment of tuition fees unless the withdrawal is formally reported to the Office of the Registrar. A student who leaves the university after the second week receives F grades in all courses.

Readmission

A student who is dismissed for any reason, or who withdraws during a bi-semester, or who fails to register for the next regularly scheduled bi-semester may not register again without receiving permission from the Dean to re-enter. Students seeking re-entry must initiate the process at least 3 weeks prior to the beginning of the bi-semester for which registration is sought.

Marks Distribution

The performance of a student in the course is evaluated on the basis of a schedule of continuous assessment. The distribution of marks for a course is as follows:

Class Participation	10%
Home Assignment & Presentation	10%
Mid-term Examination	20%
Course Final Examination	60%

The distribution of marks for a Lab course is as follows:

Laboratory Participation	10%
Laboratory Performance	10%
Lab Final Examination	40 %
Lab Reporting	20%
Viva Voce	20%

Basis for allocating marks for class participation will be as follows:

Attendance	**Marks**
90% and above	10
85% to less than 90%	09
80% to less than 85%	08
75% to less than 80%	07
70% to less than 75%	06
65% to less than 70%	05
60% to less than 65%	04
Less than 60%	00

Grading system:

The following uniform grading system approved by the UGC for all Universities is applied in the examinations for students admitted for graduation programs.

Numerical Grade	Letter Grade	Grade Point
80% and above	A + (A plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A – (A minus)	3.50
65% to less than 70%	B + (B plus)	3.25
60% to less than 65%	B (B regular)	3.00
55% to less than 60%	B – (B minus)	2.75
50% to less than 55%	C + (C plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Course Structure

The Bachelor of Science in Civil Engineering Program consists of the following categories of courses:

S.L	Courses	Credits needed to complete		Total Credit offered
		Theory	Lab	
1	Basic science	9	3	12
2	Mathematics	9	0	9
3	Humanities, Social science and Business	8	1.5	9.5
4	Basic Engineering	30	18	48
5	Core Civil Engineering	44	10.5	54.5
6	Civil Engineering Practices	10	1.5	11.5
7	Optional Civil Engineering	8	3	11
8	Thesis/Project	0	4.5	4.5
Total		**118**	**42**	**160**

List of Courses

Sl. No.	Course Code	Course Title	Credit
Basic Science			
1	PHY 112	Physics I	3
2	PHY 123	Physics II	3
3	PHY 113	Physics lab	1.5
4	CHEM 115	General Chemistry	3
5	CHEM 116	Chemistry Lab	1.5
Total			**12**
Mathematics			
6	MATH 114	Mathematics I	3
7	MATH 132	Mathematics II	3
8	MATH 211	Mathematics III	3
Total			**9**
Humanities, Social Science and Business			
9	ENG 111	English Language	2
10	ENG 112	English Language Sessional	1.5
11	HUM 112	Bangladesh Studies	2
12	HUM 131	Engineering Economics	2
13	HUM 125	Accounting	2
Total			**9.5**
Basic Engineering			
14	CE 100	Engineering Drawing I	1.5
15	CE 110	Engineering Drawing II	1.5

16	CE 101	Engineering Mechanics	3
17	CE 103	Surveying	3
18	CE 135	Practical Surveying	1.5
19	EEE 125	Basic Electrical Technology Lab	1.5
20	CSE 132	Computer Language Lab	1.5
21	CE 205	Workshop	1.5
22	CE 201	Engineering Materials	3
23	CE 202	Engineering Materials Lab	1.5
24	CE 208	Details of Estimating	1.5
25	CE 204	Details of Construction I	1.5
26	CE 206	Details of Construction II	1.5
27	CE 211	Mechanics of Solids I	3
28	CE 213	Mechanics of Solids II	3
29	CE 212	Strength of Materials Lab	1.5
30	CE 271	Fluid Mechanics	3
31	CE 272	Fluid Mechanics Lab	1.5
32	CE 273	Hydrology	3
33	CE 203	Engineering Geology & Geomorphology	3
34	CE 224	Applied Mathematics for Civil Engineering	3
35	CSE 231	Numerical Analysis & Computer Programming	3
Total			**48**
Core Civil Engineering			
Structural Engineering			
36	CE 311	Structural Analysis & Design I	3
37	CE 312	Structural Analysis & Design Lab I	1.5

38	CE 315	Design of Concrete Structures I	3
39	CE 313	Structural Analysis & Design II	3
40	CE 316	Design of Concrete Structure Lab I	1.5
41	CE 412	Design of Concrete Structure Lab II	1.5
42	CE 317	Design of Concrete Structures II	3
43	CE 411	Structural Analysis & Design III	3
Total			**19.5**
Environmental Engineering			
44	CE 331	Environmental Engineering I	3
45	CE 332	Environmental Engineering Lab I	1.5
46	CE 333	Environmental Engineering II	3
47	CE 433	Environmental Pollution Control	3
Total			**10.5**
Geotechnical Engineering			
48	CE 341	Geotechnical Engineering I	3
49	CE 342	Geotechnical Engineering Lab I	1.5
50	CE 343	Geotechnical Engineering II	3
51	CE 441	Geotechnical Engineering III	2
Total			**9.5**
Transportation Engineering			
52	CE 351	Transportation Engineering I	3
53	CE 452	Transportation Engineering Lab I	1.5
54	CE 453	Transportation Engineering II	3
Total			**7.5**
Water Resources Engineering			

55	CE 371	Open Channel Flow	3
56	CE 421	Irrigation and Flood Control	3
57	CE 372	Water Resources Engineering Lab I	1.5
Total			**7.5**
Civil Engineering Practice			
58	CE 207	Business Communication & Career Development	3
59	CE 303	Professional Ethics & Environmental Protection	3
60	CE 401	Project Planning and Management	4
61	CE 402	Professional Practices and Communication Sessional	1.5
Total			**11.5**
Thesis/Project			
62	CE 500	Thesis/Project	4.5
Total			**4.5**
Optional Civil Engineering (Students will take at least three theories and one laboratory courses from his/her major area and one theory and one laboratory courses from other areas.)			
A. Structural Engineering (Major)			
	Course Code	**Course Title**	**Credit**
Major Area	CE 465	Design of Concrete Structure Lab III	1.5
	CE 423	Pre-stressed Concrete	2
	CE 413	Structural Analysis & Design IV	2
	CE 419	Introduction to Finite Element Method	2
	CE 420	Structural Dynamics	2
	CE 417	Design of Steel Structures	2
Minor Area	Students will take at least one theory and one laboratory courses from other areas (like Environmental Engineering, Geotechnical Engineering, Transportation Engineering and		

	Water Resources Engineering.)	
Minimum Total Credit		**11**

B. Environmental Engineering (Major)

	Course Code	**Course Title**	**Credit**
Major Area	CE 432	Environmental Engineering Lab II	1.5
	CE 437	Solid Waste Management	2
	CE 431	Environmental Engineering III	2
	CE 435	Environmental Development Project	2
Minor Area	Students will take at least one theory and one laboratory courses from other areas (like Structural Engineering, Geotechnical Engineering, Transportation Engineering and Water Resources Engineering)		
Minimum Total Credit			**11**

C. Geotechnical Engineering (Major)

	Course Code	**Course Title**	**Credit**
Major Area	CE 442	Geotechnical Engineering Lab II	1.5
	CE 443	Geotechnical Engineering-IV	2
	CE 445	Geotechnical Engineering-V	2
	CE 447	Geotechnical Engineering-VI	2
Minor Area	Students will take at least one theory and one laboratory courses from other areas (like Environmental Engineering, Structural Engineering, Transportation Engineering, and Water Resources Engineering)		
Minimum Total Credit			**11**

D. Transportation Engineering (Major)

	Course Code	**Course Title**	**Credit**
Major	CE 454	Transportation Engineering Lab II	1.5

Area	CE 451	Transportation Engineering.-III	2
	CE 455	Transportation Engineering.-IV	2
	CE 457	Transportation Engineering.-V	2
Minor Area	Students will take at least one theory and one laboratory courses from other areas (like Environmental Engineering, Geotechnical Engineering, Structural Engineering, and Water Resources Engineering)		
Minimum Total Credit			**11**

E. Water Resources Engineering (Major)

	Course Code	Course Title	Credit
Major Area	CE 474	Water Resources Engineering Lab II	1.5
	CE 475	River Engineering	2
	CE 477	Coastal Engineering	2
	CE 479	Hydraulic Structures	2
	CE 473	Ground Water Engineering	2
Minor Area	Students will take at least one theory and one laboratory courses from other areas (like Environmental Engineering, Geotechnical Engineering ,Transportation Engineering and Structural Engineering)		
Minimum Total Credit			**11**
Overall Total Credit			**160**

* A student will choose only one option from A, B, C, D and E sections.

* Student must have to complete MATH-1103 (Basic Mathematics) as non credits Course in first semester; if he/she didn't have mathematics in his/her H.S.C program.

Allocation of Courses to Semesters

1st Semester / L-1, T-1

Course Code	Course Title	Contact Hours/Week	Credits
CE 101	Engineering Mechanics	3	3
CE 100	Engineering Drawing I	3	1.5
PHY 112	Physics I	3	3
PHY 113	Physics Lab	3	1.5
MATH 114	Mathematics I	3	3
CHEM 115	General Chemistry	3	3
CHEM 116	Chemistry Lab	3	1.5
ENG 111	English Language	2	2
HUM 112	Bangladesh Studies	2	2
Total		**25**	**20.5**

2nd Semester/ L-1, T-2

Course Code	Course Title	Contact Hours/Week	Credits
CE 103	Surveying	3	3
CE 110	Engineering Drawing II	3	1.5
PHY 123	Physics II	3	3
MATH 132	Mathematics II	3	3
HUM 131	Engineering Economics	2	2
EEE 125	Basic Electrical Technology Lab	3	1.5
HUM 125	Accounting	2	2
CSE 132	Computer Language Lab	3	1.5
ENG 112	English Language Sessional	3	1.5
CE 135	Practical Surveying	3	1.5
Total		**28**	**20.5**

3rd Semester/ L-2, T-1

Course Code	Course Title	Contact Hours/Week	Credits
CE 201	Engineering Materials	3	3
CE 202	Engineering Materials Lab	3	1.5
CE 203	Engineering Geology & Geomorphology	3	3
CE 204	Details of Construction I	3	1.5
CE 205	Workshop	3	1.5
CE 211	Mechanics of Solids I	3	3
MATH 211	Mathematics III	3	3
CE 273	Hydrology	3	3
Total		**24**	**19.5**

4th Semester/ L-2, T-2

Course Code	Course Title	Contact Hours/Week	Credits
CE 208	Details of Estimating	3	1.5
CE 212	Strength of Materials Lab	3	1.5
CE 213	Mechanics of Solids II	3	3
CE 271	Fluid Mechanics	3	3
CE 272	Fluid Mechanics Lab	3	1.5
CE 224	Applied Mathematics for Civil Engineering	3	3
CE 207	Business Communication & Career Development	3	3
CSE 231	Numerical Analysis & Computer Programming	3	3
CE 206	Details of Construction II	3	1.5
Total		**27**	**21**

5th Semester/ L-3, T-1

Course Code	Course Title	Contact Hours/Week	Credits
CE 311	Structural Analysis & Design I	3	3
CE 315	Design of Concrete Structures I	3	3
CE 331	Environmental Engineering I	3	3
CE 332	Environmental Engineering Lab I	3	1.5
CE 342	Geotechnical Engineering Lab I	3	1.5
CE 341	Geotechnical Engineering I	3	3
CE 371	Open Channel Flow	3	3
CE 303	Professional Ethics & Environmental Protection	3	3
Total		**24**	**21**

6th Semester/ L-3, T-2

Course Code	Course Title	Contact Hours/Week	Credits
CE 312	Structural Analysis & Design Lab I	3	1.5
CE 313	Structural Analysis & Design II	3	3
CE 316	Design of Concrete Structures Lab I	3	1.5
CE 317	Design of Concrete Structures II	3	3
CE 351	Transportation Engineering I	3	3
CE 333	Environmental Engineering II	3	3
CE 343	Geotechnical Engineering II	3	3
CE 372	Water Resources Engineering Lab I	3	1.5
Total		**24**	**19.5**

7th Semester / L-4, T-1

Course Code	Course Title	Contact Hours/Week	Credits
*CE 500	Thesis/Project	3	1.5
CE 412	Design of Concrete Structure Lab II	3	1.5
CE 411	Structural Analysis & Design III	3	3
CE 421	Irrigation and Flood Control	3	3
CE 401	Project Planning and Management	4	4
CE 402	Professional Practices & Communication Sessional	3	1.5
CE 452	Transportation Engineering Lab I	3	1.5
CE 453	Transportation Engineering II	3	3
CE 433	Environmental Pollution Control	3	3
Total		**28**	**22**

* This credit will be assessed at the end of 4th Year 2nd Term.

8th Semester/ L-4, T-2

Course Code	Course Title	Contact Hours/Week	Credits	Major/Minor Area Course Selection
CE 500	Thesis/Project	6	3.0	Compulsory
CE 465	Design of Concrete Structure Lab III	3	1.5	Compulsory for Structure major or minor.
CE 423	Pre-stressed Concrete	2	2	For Structural Engineering, Select 3 courses from this group.
CE 413	Structural Analysis & Design IV	2	2	
CE 419	Introduction to Finite Element Method	2	2	
CE 420	Structural Dynamics	2	2	
CE 417	Design of Steel Structures	2	2	
CE 432	Environmental Engineering Lab II	3	1.5	Compulsory for Environment major or minor
CE 437	Solid Waste Management	2	2	For Environment Engineering , Select 3 courses from this group
CE 431	Environmental Engineering III	2	2	
CE 435	Environmental Development Project	2	2	
CE 442	Geotechnical Engineering Lab II	3	1.5	Compulsory for Geotechnical major or minor

CE 441	Geotechnical Engineering-III	2	2	For Geotechnical Engineering , Select 3 courses from this group
CE 443	Geotechnical Engineering-IV	2	2	
CE 445	Geotechnical Engineering-V	2	2	
CE 447	Geotechnical Engineering-VI	2	2	
CE 454	Transportation Engineering Lab II	3	1.5	Compulsory for Transportation major or minor
CE 451	Transportation Engineering.-III	2	2	For Transportation Engineering , Select 3 courses from this group
CE 455	Transportation Engineering.-IV	2	2	
CE 457	Transportation Engineering.-V	2	2	
CE 474	Water Resources Engineering Lab II	3	1.5	Compulsory for Transportation major or minor
CE 475	River Engineering	2	2	For Geotechnical Engineering , Select 3 courses from this group
CE 477	Coastal Engineering	2	2	
CE 479	Hydraulic Structures	2	2	
CE 473	Ground Water Engineering	2	2	
Total		22	16	

Total Credits

Semester	**Credits**
Semester 1	20.5
Semester 2	20.5
Semester 3	19.5
Semester 4	21
Semester 5	21
Semester 6	19.5
Semester 7	22
Semester 8	16
Total Credits	**160**

DETAILS SYLLABUS OF THE COURSES

1st Semester/ L-1, T-1

CE 101: Engineering Mechanics
3.0 credits, 3hrs/week

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.

Reference Books:

1 V.M. Faires & S.D. Chambers, *Analytic Mechanics*
2.R.S. Khurmi, *A text book of Engineering Mechanics*
3. R.K. Bansal, *Textbook of Engineering Mechanics*

CE 100: Engineering Drawing I
1.5 credits, 3hrs/week

Introduction: lettering, numbering and heading; plane geometry: pentagon, hexagon, octagon, ellipse, parabola and hyperbola. Projection (solid geometry): cube, triangular prism, square prism, pentagonal prism, hexagonal prism, cone, cylinder. Development: cube, pyramid, Cone, prism; section and true shape: cube, pyramid, cone and prism. Isometric Drawing: cube, pyramid, cone. Oblique drawing: cube, pyramid, cone, Interpretation of Solids. Plan, elevation and section of one storied buildings.

Reference Books:

1. Agarwal, *Engineering Drawing*
2. B Bhattacharyya, *Engineering Graphics*
3. K. Morling, *Geometric and Engineering Drawing*

PHY 112: Physics-I
3.0 credits, 3hrs/Week

1. **Mechanics:** Basic concepts of mechanics; Statistics of particles and rigid bodies; Coplanar and non-coplanar forces; Centroids of lines, areas and volumes; Friction; Moments of inertia of areas and masses; Relative motion; Kinetics of particles; Newton's Second Law of motion; Principles of work; Energy; Impulse and momentum; System of particles; Kinetics of plane motion of rigid bodies; Forces and acceleration; Principles of work and energy.

2. **Heat & 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, Van der Waal's equation of state review of the First Law of thermodynamics and its application, reversible and irreversible processes. Second Law of Thermodynamic, Carnot Cycle, Efficiency of heat engines, Carnot's Theory, Entropy and Disorder, Thermodynamics Functions, Maxwell Relations, Clausius-Clayperon Equation, Gibbs Phase Rule, Third Law of Thermodynamics.

3. **Waves & Oscillations:** Differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Luscious figures, spring-mass system, calculation of time period of tensional 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.

Reference Books:

1. DR. GIAS UDDIN A., *Physics for Engineers*, 2005
2. BRIJLAL, *Optics*, 2001
3. Zemansky, *Heat & Thermodynamics*

PHY 113: Physics Lab
1.5 credits, 3hrs/week

Determination of the specific heat of a liquid by the method of cooling. Determination of the thermal conductivity of a bad conductor by Lee's method. Determination of the pressure co-efficient of air by constant volume air thermometer. Determination of the frequency of a tuning fork by Melde's apparatus. Determination of the focal length of concave lens by auxiliary lens method. Measurement of unknown resistance and verification of the laws of resistance by P.O. (Post Office) box. Comparison of the E.M.F's of two cells by potentiometer. Determination of the mechanical equivalent of heat by electrical method. Determination of the radius of curvature of a plano-convex lens by Newton's ring method. Determination of threshold frequency for the photoelectric effect of a photocathode and the value of the Planck's constant. To plot thermo-electromotive force-temperature (calibration) curve for a given thermocouple. Determination of the melting point of a solid using the calibration curve. Determination of the specific rotation of sugar solution by a polarimeter. Determination of the temperature co-efficient of the resistance of the material of a wire. Determination of the refractive index of the material of a prism using spectrometer. Determination of the spring constant and the effective mass of a loaded spring.

MATH 114: **Mathematics I**
3.0 Credits, 3hrs/week

Differential Calculus*:* Limit, Continuity and Differentiability, Successive Differentiation of functions, Leibnitz Theorem, Rolle's Theorem, Mean Value Theorem, Taylor and Maclaurin's Theorems in finite and infinite forms, Lagrange's form of remainders, Cauchy's form of remainders, Evaluation of intermediate forms by L. Hospitals Rule, Partial differentiation, Euler's Theorem, Tangent and Normal, Subtangent and Subnormal in Cartesian and polar coordinates,

Determination of maximum and minimum values of functions and points of inflection, Curvature, radius, circle, center and chord of curvature, Asymptotes.

Integral Calculus*:* Review of indefinite and definite integration of various types of functions, Fundamental Theorem of Integral Calculus, Use of definite integration in summing series, Improper integrals, Beta function and Gamma functions, Reduction Formula, Area under a plane curve and area of a region enclosed by two curves in Cartesian and polar coordinates, Volume and Surface areas of solids of revolution.

Reference Books:

1. B.C. Das, *Differential Calculus*
2. S. Balachandra Rao, *Differential Calculus*
3. A.K. Sharma, *Text Book of Integral Calculus*

CHEM 115: General Chemistry
3.0 Credits, 3hrs/week

1. Atomic structure, periodic table, chemical bonds. Chemistry of cement, silicates and limes. Physical and chemical properties of water.

2. Different types of solutions, concentration units. Chemical equilibrium and thermo chemistry.

3. **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.

4. **Colloid and colloidal solution:** classification, preparation, purification, properties, protective action and application of colloids.

5. **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 protective measures.

6. **Chemistry of environmental pollution:** environment and its characteristics, chemistry of toxic metal and non-metal pollutants, analytical techniques used in the determination of pollutants, chemical concept of DO, BOD, COD and threshold odour number, chemistry involved in water treatment plants, quality of industrial waste water.

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

8. **Paints and varnishes:** introduction to paints and varnishes, pre-treatment of the surface, metallic, non-metallic and organic protective coatings, types of paints and their uses.

Reference Books:

1. Darrell D.E. & Steven D.G., *General Chemistry*, 9th ed.
2. Raymond C. & Jason O., *General Chemistry The Essential Concepts*, 6th ed.
3. Bassam Z. Shakhashiri and Rodney Schreiner, *Workbook for General Chemistry*

CHEM 116: Chemistry Lab
1.5 credits, 3hrs/week

Inorganic Quantitative Analysis, volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu and Ca volumetrically. BOD, COD tests, application of colloids, chemical properties of water, determination of pollutants.

ENG 111, English Language
2.0 credits, 2hrs/week

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures, wh & yes/no questions, conditional sentences. *Vocabulary:* Technical& scientific vocabulary, defining terms. *Spoken English:* Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.
Reading: Comprehension of technical & non-technical materials-skimming, scanning, inferring & responding to context. *Technical Writing:* Paragraph& composition writing on scientific & other themes, report writing, research paper writing, library references. *Professional communication:* Business letter, job application, memos, quotations, tender notice.

Reference Books:

1. Soars, L. & Soars, J., *New Headway English Course*
2. Strrvens, P., *Spoken Language*
3. Strrvens, P., *Aural Aids in Language Teaching*

HUM 112: Bangladesh Studies
2.0 credits, 2hrs/week

Bangladesh Studies
Introduction to Bangladesh Studies, History of Bangladesh, Climate &Seasons, Topography, Rivers of Bangladesh, Environment, Social Structure, and Bangladesh Economics, Foreign Relationship & Politics, Foreign Aids & International Cooperation, Agriculture of Bangladesh, Cultural Heritage of Bangladesh, Archeological Heritage, Ethnic Groups in Bangladesh, Tourism in Bangladesh etc.

Reference Books:

1."Banglapedia, 2003" -by Asiatic Society of Bangladesh
2. The History of Bengal (Vol.1 &Vol.2)- by R.C. Majumdar
3. Bangladesh Studies & Culture by Sumon Das, M.N. Mohabbat
4. Bangladesh Studies by Md.Shamsul Kabir Khan & Dr. Daulatunnaher Khan

2nd Semester/ L-1, T-2

CE 103: Surveying
3.0 Credits, 3hrs/week

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. Tachometry: introduction, principles and problems on tachometry. 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 global positioning system (GPS).

Reference Books:

1. B.C. Punmia, *Surveying* Vol. 1, 2, 3
2. N.N.Basak, *Principals of Surveying*
3. Alfred Leick , *GPS satellite surveying*
4. K. Srinivasa Raju, *Elementary Surveying*

CE 110: Engineering Drawing II
1.5 credits, 3hrs/week

Plan, elevation and sections of multi-storied buildings; reinforcement details of beams, slabs, stairs etc. Plan and section of septic tank; detailed drawing of roof truss; plan, elevation and sections of culverts, bridge's and other hydraulic structures; Building services drawings; introduction to computer aided drafting.

PHY 123: Physics II
3.0 credits, 3 hrs/week

1. **Structure Matter:** States of matter: solid, liquid and gas. Classification of solids: anorphous, Crystalline, ceramics and polymers. Atomic arrangement in solids. Different types of bonds in solids: metallic, Vander Waals, covalent and ionic bond, packing in solids, interatomic distances and forces of equilibrium, x-ray diffraction; Bragg's law. Plasticity and elasticity. Distinction between metal, insulator and semi-conductor.

2. **Electricity and Magnetism:** Electric charge, Coulomb's law, the electric field: calculation of'the electric field strength, E; a dipole in an electric field, electric flux and Gauss's law, some application of Gauss's law; electric potential V, relation between E and V, electric potential energy. Capacitors; capacitance, dielectrics; and atomic view, dielectrics and Gauss's law; current and resistance: current and current density, Ohm's law, resistivity: an atomic view, Ampere's Law, Faraday's law, Lenz's law, self-inductance and mutual inductance. Magnetic properties of matter: magnetomotive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, magnetization curves.

3. **Modern Physics:** Michelson Morley's experiment, Galilean transformation, special theory of relativity,' Lorentz-transformation, relative velocity, length contraction, time

dilation, mass-energy relation. Photoelectric effect, Compton effect, de-Broglie wave, Bohr's atom model. Radioactive decay, half-life, mean life, isotopes, nuclear binding energy, alpha, beta, gamma decay.

Reference Books:

1. Kenneth S. Krane, *Modern Physics*
2. Duan Feng, Guojun Jin, *Introduction to Condensed Matter Physics*, Volume 1
3. James Clerk Maxwell, *A Treatise on Electricity and Magnetism*
4. Edward Purcell, *Electricity and Magnetism*

MATH 132: Mathematics II
3.0 credits, 3hrs/week

Ordinary differential equations*:* Classification of Differential Equation, Initial-Value Problem and Boundary-Value Problem, Degree and order of ODE, Solution of first order Differential equations by various methods, Solution of first order but higher degree ODE, Solution of general linear equations of second and higher order with constant coefficients, Solution of homogeneous linear equations and its applications, Solutions of Differential equations of higher order when dependent and independent variable are absent, Solution of differential equation by the method based on factorization of operators.

Partial differential equations*:* Four rules for solving simultaneous equations of the form $dx / P = dy / Q = dz / R$; Lagrange's Method of solving PDE of order one, Integral surfaces passing through a given curve, Non-linear PDE of order one (Complete, Particular, Singular and general integrals) ; Standard forms **f(p,q)=0, z=px+qy+f(p,q), f(p,q,z) = 0, $f_1(x,p) = f_2(y,q)$** Charpit's Method, Second order PDE; Its nomenclature and classifications to canonical (Standard) parabolic, elliptic, hyperbolic, Solution by separations of variables, Linear PDE with constants coefficients.

Statistics: Frequency distribution and its graphical representation; Mean, Median, Mode and other measures of central tendency; Standard deviation and other measures of dispersion; Moments; Skewness and Kurtosis; Elementary probability theory; Expectation; Discontinuous probability distributions (Binomial, Poison and Negative binomial); Continuous probability distributions (Normal and Exponential); Sampling theory; Estimation theory; Hypothesis testing; Correlation and regression analysis.

Reference Books:

1. "Ordinary and Partial Differential Equation" -by M. D Raisinghania
2. "Integral Calculus and Differential Equations" -by Mohammad and Bhattacharjee

EEE 125: Basic Electrical Technology Lab
1.5 credits, 3hrs/week

Measurement of electrical quantities current, sinusoidal single phase RLC circuits**,** measurement of current, voltage, resistance. Measuring instruments; ammeters, voltmeters, watt meters and multimeters, electronics principles with applications.

CSE 132: Computer Language Lab
1.5 credits, 3hrs/week

Operating system for micro COMP Liters; development of FORTRAN programs and Solution of problems using a computer; solution of Civil Engineering problems by microcomputers, application of C and C++ to solve civil engineering problems.

CE 135: Practical Surveying
1.5 Credits, 3hrs/week

Reconnaissance survey, traverse Survey, leveling, contouring**,** curve ranging, transition curve, vertical curves. Calculation of areas and volumes, photogrammetry, introduction to global positioning system, tachometry.

HUM 131: Engineering Economics
2.0 credits, 2hrs/week

Fundamentals of basic economics: Money, **c**ost / price, utility, supply, demand, investment, depreciation, inflation, economic theories, Five year planning.

Introduction to engineering economics: Present economy, role of engineers in economic system and business.

Engineering economic decisions: Types of engineering decisions, material and process selection, equipment replacement, new product and product expansion, cost reduction, service improvement, time value of money, present worth analysis, cash flow analysis and depreciation, sensitivity analysis, break-even analysis, risk analysis, multi-stage sequential analysis, multi attribute decision making; Investment: Measuring the worth of investment, evaluation of multiple investment alternatives, effect of inflation on engineering practices, sensitivity and risk analysis.

Application of Engineering Economy: Aspects of economic studies for government activities, Economic aspects of engineering studies and projects, Case Studies. Financial aspects of water supply and sanitation projects, Transportation economics, water resources economics, environmental economics.

Reference Books:

1. Kal Renganathan Shorma, Fundamentals of Engineering Economics.
2. N. Gregory Mankiw, Principles of Economics.
3. E. K. Hunt, History of Economic Thought
4. John B. Taylor, Akila Weerapana, Economics

HUM 125: Accounting
2.0 credits, 2hrs/week

Basic accounting principles, Transaction, Journal, Ledger and Accounts. Cash book, Bank Reconciliation statement. Preparation of Financial Statement. Cost Accounts and its objects. Cost classification. Elements of costs, preparation of cost sheet. Overhead allocation. Use of Relevant costs in Decision-Making, Standard costing. Material cost variance. Break even analysis.

Reference Books:

1. "Principle of Accounting"- by Kieso
2. "Principle of Accounting"- by Belverd E. Needles and Marian Powers
3. "Financial&Managerial Accounting" -by Jan Williams,Susan Haka,Mark Bettner.

ENG 112: English Language Sessional

1.5 credits, 3hrs/week

Grammar: tense, article, preposition, subject-verb agreement, clause, conditional and sentence Structure.

Vocabulary building: Correct and practice diction, affixes, level of appropriateness, colloquial and standing, informal and formal.

Developing reading skill: Strategic of reading, skimming, scanning, predicting, inferring, analyzing and interpreting variety of texts, practicing comprehension from literary and nonliterary texts.

Developing writing skill: Sentences, sentence variety, generating sentences, clarity and Correctness of sentences, linking sentences to form paragraphs, writing paragraphs, essays and reports, formal and informal letters.

Listening skill and note talking: Listening sentences to recorded texts and class lectures and learning to take useful notes based on listening,

Developing speaking: oral skills including communicative expressions for personal identification, life at home, giving advice and option, instruction and directions, requests, complaints, apologies people and places, narrating events.

3rd Semester / L-2,T-1

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

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.

Reference Books:

1. Rangawalla, *Engineering Materials*
2. M.A. Aziz, *Engineering Materials*
3. Steven H. Kosmatka, Beatrix Kerkhoff, *Design and Control of Concrete Mixtures*

CE 202: Engineering Materials Lab
1.5 Credits, 3hrs/week

Based on Engineering Materials Theory Classes. (FM of Sand, concrete, final and initial setting time of cement, tensile and compressive strength test of cement).

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

Minerals; identification of minerals, common rock forming minerals; physical properties of minerals; mineraloids rocks; types of rocks, cycle of rock change; earthquake and seismic map of' Bangladesh
Structural geology; faults; types of faults; fold and fold type; domes; basins; erosional process; quantitative analysis of erosional land forms.
Channel development; channel widening; valley shape; stream terraces; alluvial flood plains; deltas and alluvial fans; channel morphology; channel patterns and the river basin; geology and geomorphology of Bangladesh.

Reference Books:

1. Avijit Gupta, *Large Rivers: Geomorphology and Management*
2. Richard J. Huggett, *Fundamentals of Geomorphology*
3. Kesavulu, *Textbook of Engineering Geology*
4. F. C. Beavis, *Engineering geology*
5. P.C. Rao & D.B. Rao, *A Text* Book *of Geology*
6. S. B. Bhagwat, *Foundation of Geology*

CE 205: Workshop
1.5 Credits, 3hrs/week

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

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

Welding Shop
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, aluminum; Type of electrode, fluxes and their composition; Arc welding defects; Test of Arc welding: Visual, destructive and non-destructive tests. Types of gas welding system and gas welding equipment; Gases and types of flame; welding of different types of materials; Gas welding defects; test of gas welding.

CE 211: Mechanics of Solids I
3.0 credits, 3hrs/week

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.

Reference Books:

1. L. Singer, *Strength of Materials*
2. Srinath, *Advanced Mechanics of Solids*
3. Singh, *Mechanics* of *Solids*
4. Dr. B.C. Punmia, *Mechanics of Materials*

MATH 211: Mathematics III
3.0 credits, 3hrs/week

Coordinate Geometry of three dimensions: System of co-ordinate; Distance between two points; Section formula; Projection; Direction cosines; Equation of planes and lines; Condition of perpendicularity and parallelism of planes and straight lines; Perpendicular distance of a point from a straight line; Coplanar lines; Shortest distance between two straight lines; Volume of a tetrahedron; Sphere, cone and cylinder with their properties.

Spherical Trigonometry: Spherical triangle; Properties of Spherical triangle; Relations between sides and angles of a spherical triangle; Solution of spherical triangle.

Vector Analysis: Review of vector algebra; Multiple product; Vector differentiation: elementary differentiation, gradient, divergence, curl; Vector integration: ordinary integrals, line integrals, surface integrals, volume integrals; Integral theorems: Green's theorem, Gauss' divergence theorem, Stokes' theorem; Curvilinear coordinates: Orthogonal coordinates, spherical polar coordinates, cylindrical polar coordinates.

Reference Books:

1. "Schaum's Outline of Complex Variables"-by Murray Spiegel,
2. "A Text Book on Coordinate Geometry"-by Rahman and Bhattacharjee
3. "The Elements of Coordinate Geometry"-by S. L. Loney.
4. "Vector Analysis" - by Dr. Muhammad AbdusSattar.

CE 273: Hydrology
3.0 credits, 3hrs/week

Hydrologic cycle. Weather and Hydrology. Precipitation, Evaporation and transpiration. Infiltration. Stream flow. Application of telemetry and remote sensing in hydrologic data acquisition. Rainfall runoff relations. Hydrographs, unit hydrographs. Hydrologic routing. Statistical methods in hydrology.

Reference Books:

1. H.M. Raghunath, *Hydrology Principal Analysis & Design*
2. P.J. Reddi, *A Text book of Hydrology*
3. Subramanya, *Engineering Hydrology*
4. Das & Saikia, *Hydrology*

CE 204: Details of Construction I
1.5 credits, 3hrs/week

Foundations, different types of foundations; Brick masonry; framed structure and bearing walls; Arches and lintels; Details of floors and roofs; Pointing; Plastering and interior finishing; Scaffolding and staging; Shoring and underpinning; Thermal insulation and acoustics; Types and construction details of stairs; House plumbing; Detection, alarm & fire-fighting system.

4th Semester/ L-2, T-2:

CE 213: Mechanics of solids II
3.0 credits, 3hrs/week

Torsional stresses in shafts and tubes; Compound stresses; Helical springs; Transformation of tresses; deflection of beams by direct integration, moment area, elastic load and conjugate beam methods; buckling of columns.

Reference Books:

1. B.C. Punmia, SMTS-II Theory of Structures
2. Otto T. Bruhns, Advanced Mechanics of Solids
3. John Case, Strength of Materials and Structures
4. Dr. B.C. Punmia, Arun Kr. Jain, Mechanics of Materials
5. A. C. Ugural, Advanced strength and applied elasticity
6. N. S. Trahair, Flexural-torsional buckling of structures

CE 271: Fluid Mechanics
3.0 credits, 3hrs/week

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

Reference Books:

1. P.N. Modi, *Fluid Mechanics*
2. R.K. Bansal, *A Text Book of Fluid Mechanics and Hydraulic Machines*
3. Dr. R.K. Bansal, R.K. Bansal, Dr. Bansal, R.K., *A Textbook of Fluid Mechanics*
4. R.K. Rajput, *Fluid Mechanics & Hydraulic Machines*
5. S K Agrawal, *Fluid Mechanics & Machinery*

CE 272: Fluid Mechanics Lab
1.5 credits, 3hrs/week

Centre of Pressure. Proof of Bernoulli's theorem. Flow through Venturi meter. 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.

CE 212: Strength of Materials Lab
1.5 credits, 3hrs/week

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; helical spring tests; determination of shear center; load deflection behavior of simple beam.

CE 224: Applied Mathematics for Civil Engineering
3.0 credits, 3hrs/week

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

Fourier series and its properties, application to engineering problem solving; Fourier integral; Fourier transforms and their uses in solving boundary value problems; diffusion equation, wave equation, Laplace equation and their applications.

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

Reference Books:

1. "Fourier Analysis: An Introduction" by E M Stein and R Shakarchi
2. "Introduction to Fourier Analysis" by Norman Morrison
3. "Probabilities, Random Variables and Random Processes" by Peyton Peebles
4. "Probability, Random Variables and Stochastic Processes" by A Papoulis

CE 207: Business Communication & Career Development
3.0 credits, 3hrs/week

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 analysis, marketing strategies and use of marketing tools; branding, choosing brand elements, brand extension and its advantages and disadvantages; introduction to operations management, basic production decisions of an organization, quality control within operations process.

Reference Books:

1. Raymond V. Lesikar & John D. Pettit, Basic Business Communication.

CSE 231: Numerical Analysis & Computer Programming
3.0 credits, 3hrs/week

Numerical Analysis:
Solutions of algebraic and transcendental equations: Bisection method, Regular falsi method, Newton-Raphson method, Iteration method; Rate of convergence; Order of errors; Interpolation: simple differences, difference tables, differences of a polynomial, Newton's formula for interpolation, central difference interpolation formula, divided differences, tables of divided differences, Newton's general interpolation formula, Lagrange's interpolation formula, inverse interpolation by Lagrange's formula and by successive approximation; Solutions of system of linear equations: matrices, Gaussian elimination method, Gauss-Seidal iteration method; Numerical differentiation and integration; Finite differences; Curve fitting by least squares; Solution of differential equations: Picard's method, Euler's method and Runge-Kutta method.

Computer Programming:
Introduction; Detailed study of FORTRAN language; Introduction to C; Computer applications in Civil Engineering problems.

Reference Books:

1. Eugene Isaacson, Herbert Bishop Keller, *Analysis of Numerical Methods*
2. Balagurusamy, *Numerical Methods*
3. S.S. Sastry, *Introductorymethods* of *numerical* analysis
4. V. Rajaraman, *Computer Oriented Numerical Methods*

CE 208: Details of Estimating
1.5 credits, 3hrs/week

Analysis of rates; Detailed estimate and specification of all major items of work of a building and highway; Fundamentals of costing and estimating of electrical and mechanical works.

CE 206: Details of Construction II
1.5 credits, 3hrs/week

Introduction to construction equipment for road, bridge and building, Safety in constructions; definition and classification of construction accidents, safety program for construction, Locating hazards, safety equipment.
Building Services: Introduction, Systems of plumbing, Water supply fittings, Sanitary fittings, Building drainage system.

5th Semester / L-3, T-1

CE 311: Structural Analysis & Design I
3.0 credits, 3hrs/week

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.

Reference Books:

1. T.C. Shedd & J. Vawter, *Theory of Simple Structures*
2. Yuan-yu Hsieh, S. T. Mau, *Elementary theory of structures*
3. B.C. Punmia, Arun Kr. Jain, *SMTS-II Theory of Structures*
4. Reddy, *Basic Structure Analysis*

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

Fundamental behavior of reinforced concrete; Introduction to WSD and USD methods; analysis and design of singly reinforced, doubly reinforced and T-beams according to WSD and USD methods; diagonal tension; bond and anchorage according to WSD and USD methods; one-way slabs, Two-way slabs.

Reference Books:

1. H. Nilson & David Darwin, Design of Concrete Structure, (14th Edition)
2. H. Nilson & David Darwin, Design of Concrete Structure, (7th Edition)
3. Gambhir, Design Of Reinforced Concrete Structures
4. Sinha, Handbook of reinforced concrete design
5. N.Krishna Raju, Structural Design, and Drawing: Reinforced Concrete and Steel
6. George Winter, Design of concrete structures

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

Introduction to Environmental Engineering.
Drinking water; Water, sanitation and health; Introduction to water supply; Population forecasting, water requirement. Water supply sources; Ground water exploration and problems; Aquifer properties and ground water flow; Well hydraulics and well design; Common water supply systems with specific reference to Bangladesh; Different types of hand pumps; Installation and O&M of hand pumps; Problems in water supply; Alternative water supply technologies for problematic areas in Bangladesh.
Water collection and intake; Water transmission and distribution system; Analysis and design of distribution network; Pressure conduits; Fire hydrants; Leak detection; Unaccounted loss of water.

Water quality parameters and standards; Water treatment: plain sedimentation, coagulation and flocculation, filtration, softening, disinfection; other treatment methods; Small scale iron and arsenic removal units, arsenic mitigation in Bangladesh. Socio- economic aspects of water supply and sanitation.

Reference Books:

1. M.Feroze Ahmad, *Water Supply & Sanitation*
2. ITN Bangladesh, *Water Supply & Sanitation*
3. P. Jayarama Reddy, *Municipal Solid Waste Management*

CE 332: Environmental Engineering Lab I
1.5 credits, 3hrs/week

Physical & Chemical test of water & waste water; Design of water treatment plants; design of sewerage system; laboratory analysis of air, water, Wastewater and solid wastes. Bacteriological tests of water.

CE 342: Geotechnical Engineering Lab I
1.5 credits, 3hrs/week

Field identification tests; grain size analysis by sieve and hydrometer; specific gravity test; Atterberg limits test; permeability tests; unconfined compression test; compaction test; relative density test; direct shear tests; consolidation tests.

CE 341: Geotechnical Engineering I
3.0 credits, 3hrs/week

Introduction to geotechnical engineering; Formation, composition, structure and fabrics of soils; Index properties of soils; Identification and classification of soils; Phase relationships; Soil compaction; Principles of total and effective stresses; Permeability and seepage; Capillarity and flow net; Shear strength; Stress distribution.

Reference Books:

1. B.C. Punmia, *Soil Mechanics & Foundation*
2. Barja M. Das, *Principal of Geotechnical Engineering*
3. Gopal Ranjan, A S R Rao, *Basic and Applied Soil Mechanics*
4. Purushothama Raj, *Soil Mechanics & Foundation Engineering*
5. Kaniraj, Shenbaga R. Kaniraj, *Design aids in soil mechanics and foundation engineering*

CE 371: Open Channel Flow
3.0 credits, 3hrs/week

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's and Manning's equations, estimation of resistance coefficients and computation of uniform flow. Momentum equation and specific momentum. Hydraulic jump. Theory and analysis of gradually varied flow. Computation of flow profiles. Design of channels.

Reference Books:

1. Ven Te Chow, *Open Channel Hydraulics*
2. Subramanya, *Flow in Open Channels*
3. M. Hanif Chaudhry, *Open-Channel Flow*
4. Das, *Open Channel Flow*
5. Roland Jeppson, *Open Channel Flow*
6. Subhash C. Jain, Subhash Chandra Jain, *Open-channel flow*
7. A. Osman Akan, *Open Channel Hydraulics*

CE 303: Professional Ethics & Environmental Protection
3.0 credits, 3hrs/week

Overview of Society, Science, environmental issues & technology. Society: elements, communication, association institution, industrial revolution, development of capitalism, culture, family, Crime & deviance, social control. Ethical theories: Utilitarianism, duty & rights. Obligation to employer: loyalty, conflict of interest, confidentiality. Code of ethics. The profession & law, regulations, licensing. Environmental Ethics. Environmental issues: Environmental aspects, Environmental Ethics, Environmental impact assessment & environmental protection techniques.

Reference Books:

1. Caroline White beck, Ethics in Engineering Practice & Research
2. Martin, Ethics in Engineering.
3. Sivashanmugam, P., Basics of Environmental Science and Engineering.

6th Semester / L-3, T-2

CE 312: Structural Analysis & Design Lab I
1.5 credits, 3hrs/week

Analysis and design problems; design of members and connection of steel structures; e.g. trusses and plate girders.

CE 313: Structural Analysis & Design -II
3.0 credits, 3hrs/week

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

Reference Books:

1. Bungale S. Taranath, *Wind and Earthquake Resistant Buildings*
2. John D. Holmes, *Wind Loading of Structures*
3. Russell C. Hibbeler, *Structural analysis*
4. Chu-Kia Wang, *Statically indeterminate structures*
5. Reddy, *Basic Structure Analysis*

CE 316: Design of Concrete Structures Lab I
1.5 credits, 3hrs/week

Analysis and design problems based on the fundamental behavior of reinforced concrete; design of a slab bridge, simple girder bridge, and a low-rise building.

CE 317: Design of Concrete Structures II
3.0 credits, 3hrs/week

columns; footings; retaining walls, Stair case, Lintels, Flat slabs & Flat plates , reinforced concrete floor and roof systems. Review of codes; yield line method; introduction of pre-stressed concrete.

Reference Books:

1. H. Nilson & David Darwin, *Design of Concrete Structure*, (14th Edition)
2. H. Nilson & David Darwin, *Design of Concrete Structure*, (7th Edition)
3. George Winter, *Design of concrete structures*
4. P. Bhatt, Thomas Joseph MacGinley, *Reinforced Concrete: Design Theory And Examples*
5. Raju N. Krishna, *Reinforced Concrete Design: Principles And Practice*

6. B. C. Punmia, Arun Kumar Jain, Arun Kr. Jain, *Limit State Design of Reinforced Concrete*
7. Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, *Reinforced Concrete Structures: Volume 2*
8. Bandyopadhyay, *Design of Concrete Structures*
9. Jack C. McCormac, Russell H. Brown, *Design of Reinforced Concrete*

CE 351: Transportation Engineering I
3.0 credits, 3hrs/week

Introduction to transportation engineering; development of transportation systems; elements of transportation system; transportation in Bangladesh; modal share; transportation planning concepts; collection, study and analysis of basic data; highway location and surveys; geometric design of highways; element of design, cross-section elements, Curves and sight distances; road intersection; traffic engineering: the road/traffic system, vehicle and traffic characteristics, traffic control devices, traffic studies, parking and roadway lighting; waterways and terminals.

Reference Books:

1. B.L. Gupta, *Roads, Highway, Railway & Harbour Engineering*.
2. Khanna, *Highway Engineering*
3. Sing, *Highway Engineering*
4. Ashok Kumar Jain, Urban *transport*: *planning and management*
5. S. B. Sehgal, K. L. Bhanot, *A textbook on highway engineering*
6. James H. Banks, *Introduction to transportation engineering*

CE 333: Environmental Engineering II
3.0 credits, 3hrs/week

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

Microbiology of sewage and wastewater: 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; design and construction of septic tanks, soak wells and subsurface drain fields; 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 the environment, environmental pollution; environment and management.

Reference Books:

1. Satinder Ahuja, *Handbook of WaterPurity and Quality*
2. M. Feroze Ahmed, Md Mujibur Rahman, *Water* supply & sanitation
3. George Tchobanoglous, Franklin L. Burton, H. David Stensel, *Wastewater Engineering: Treatment and Reuse*
4. B.C. Punmia, *Waste Water Engineering*
5. Marcos von Sperling, *Basic principles of wastewatertreatment*
6. Petr Hlavinek, Cvetanka Popovska, Ivana Mahrikova, *Risk Management of Water Supply and Sanitation Systems*
7. Robin Turrell, *Urban Water Supply, and Sanitation*

CE 343: Geotechnical Engineering II
3.0 credits, 3hrs/week

Soil investigation techniques; Direct measurement of consistency and relative density; Correlation of strength parameters with N-values; Lateral earth pressure; Compressibility and settlement; Bearing capacity; Slope stability analysis

Reference Books:

1. Barja M. Das, *Foundation Engineering*
2. B.C. Punmia, *Soil Mechanics & Foundation*
3. P.C. Varghese, *Foundation Engineering*
4. Robert Wade Brown, *Practical Foundation Engineering Handbook*
5. Frank Fahy, Foundations of engineering acoustics
6. Mark Thomas Holtzapple & W. Dan Reece, *Foundations of engineering*
7. Braja M. Das, *Principles of Geotechnical Engineering*

CE 372: Water Resources Engineering Lab I
1.5 credits, 3hrs/week

Experiments on sluice gate, venture flume, Parshall flume, cut-throat flume, hydraulic jump, velocity distribution profile, Manning's roughness coefficient, specific force and specific energy; GVF profile computation; Pipe surge and water hammer; Preparation and analysis of hydrographs; Aquifer characteristic.

7th Semester / L4, T-1

CE 500: Thesis/Project
1.5 credits, 3hrs/week

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

CE 411: Structural Analysis & Design III
3.0 credits, 3hrs/week

Analysis of statically indeterminate structures by displacement method; slope deflection, moment distribution, stiffness matrix; member stiffness; transformations; assembly of stiffness matrices and solution for beams, frames and trusses. Flexibility matrix. Influence lines for statically indeterminate beams, frames, arches and grids. Structural forms and their applications.

Reference Books:

1. Hibbeler, Structural Analysis
2. B.C. Punmia, Arun Kr. Jain, SMTS-II Theory of Structures
3. Jack C. McCormac, Structural analysis
4. Reddy, Basic Structure Analysis
5. Thomas Henry Gordon Megson, Structural And Stress Analysis
6. S. Rajasekaran, G. Sankarasubramanian, Computational Structural Mechanics
7. Yuan-yu Hsieh, Elementary theory of structures

CE 412: Design of Concrete Structure Lab II
1.5 credits, 3hrs/week

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

CE 402: Professional Practices and Communication Sessional
1.5 credits, 3hrs/week

The project cycle; Project proposal; Contractual provisions; Techniques of specification writing; Evaluation of bids; Project evaluation.
Interpretation of literature, documents etc; Communicating; Preparation of report; Industrial and labor relations; Professional ethics in Civil Engineering.

CE 421: Irrigation and Flood Control
3.0 credits, 3hrs/week

Importance of irrigation. Sources and quality of irrigation water. Soil-water relationship. Consumptive use and estimation of irrigation water requirements. Methods of irrigation. Design of irrigation canal system. Irrigation structures. Irrigation pumps. Problems of irrigated land. Flood and its control.

Reference Books:

1. S.K. Garg, *Irrigation Engineering & Hydraulic Structure*.
2. Basak, *Irrigation Engineering*
3. R.K. Sharma, T.K. Sharma, *Irrigation Engineering*
4. Reddy, R N Ed, *Irrigation Engineering*
5. Some Nath Ghosh, *Flood control and drainage engineering*
6. George Wellington Pickels, *Drainage and flood control engineering*

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

Principles of management; principles of construction management; construction contracts and inspection and quality control; construction safety; construction planning and specil 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.

Reference Books

1. B.C. Punmia; Ashok Kumar Jain; Arun Kumar Jain, *Building Construction*
2. Harold Kerzner, *Project Management*
3. Kohli, *Project Management Handbook*
4. K. K. Chitkara, *Construction project management*

CE 433: Environmental Pollution Control
3.0 credits, 3hrs/week

Environmental Pollution and its Control: Water pollution sources and types of pollutants; waste assimilation capacity of streams; dissolved oxygen modeling; the 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 and greenhouse effect; air pollution monitoring and control measures.

Reference Books:

1. Rajvaidya, *Environmental Pollution Control*
2. Sivashanmugam, P., Basics of *Environmental* Science and *Engineering*
3. G.K. Ghosh, *Environmental Pollution*
4. Laurent Hodges, *Environmental pollution*
5. B.D. Sharma, *Environmental Pollution*
6. Vijay P. Singh, *Environmental pollution*
7. C. S. Rao, *Environmental Pollution Control Engineering*

CE 452: Transportation Engineering Lab I
1.5 credits, 3hrs/week

Tests on bituminous materials, tests on sub grade, sub base and base materials; mix design; roadway capacity studies.

CE 453: Transportation Engineering II
3.0 credits, 3hrs/week

Highway 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; equipment; railways: general requirements, alignment, permanent way, station and yards, signaling, points and crossings, maintenance.

Reference Books:

1. B.L. Gupta, *Roads, Highway, Railway & Harbour Engineering*
2. Harold N. Atkins, *Highway materials, soils, and concretes*
3. S. B. Sehgal, K. L. Bhanot, *A text book on highway engineering*
4. Partha Chakroborty, Animesh Das, *Principles of Transportation Engineering*
5. Vassilios A. Profillidis, *Railway management and engineering*
6. Satish Chandra, M. M. Agarwal, *Railway Engineering*
7. Robert N. Hunter, *Bituminous mixtures in road construction*
8. Michel Ruban, *Quality control in road construction*

8th Semester/ L-4, T-2

CE 500: Thesis/Project
3.0 credits, 6hrs/week

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

CE 465: Design of Concrete Structure Lab III

1.5 credits, 3hrs/week

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

CE 423: Pre-stressed Concrete
2.0 credits, 2hrs/week

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

Design of prestressed sections for flexure, shear, bond and bearing.

Reference Books:

1. F. K. Kong, Reinforced Concrete Deep Beams
2. Krishna Raju, Prestressed concrete
3. Rhydwyn Harding Evans, Ernest Walter Bennett, Pre-stressed concrete, theory, and design
4. Kurt Billig, Pre-stressed reinforced concrete
5. Kit Yan Lau, Pre-stressed concrete

CE 413: Structural Analysis and Design IV

2.0 credits, 2hrs/week

Introduction to theory of elasticity plane stress and plane strain conditions; Two-dimensional problems in re-circular and polar coordinates; torsion of circular and non-circular shafts; instability of structures; stability functions. 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.

Reference Books:

1. Hibbeler, *Structural Analysis*
2. B.C. Punmia, Arun Kr. Jain, *SMTS-II Theory of Structures*
3. Jack C. McCormac, *Structural analysis*
4. Reddy, *Basic Structure Analysis*
5. Thomas Henry Gordon Megson, *Structural And Stress Analysis*
6. S. Rajasekaran, G. Sankarasubramanian, *Computational Structural Mechanics*

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

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.

Reference Books:

1. Yuan-yu Hsieh, Elementary theory of structures
2. Thomas J.R. Hughesw, The Finite Element method
3. Robert j. Witt, Concepts & Applications Finite Elements Methods

CE 420: Structural Dynamics
2.0 credits, 2hrs/week

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

Reference Books:

1. Anil K. Chopra, *Structural Dynamics*
2. Jack C. McCormac, *Structural analysis*
3. Roy. R. Craig Jr., *Fundamentals of Structural Dynamics*

CE 417: Design of Steel Structures
2.0 credits, 2hrs/week

Behavior of structural steel members and steel frames; Code requirements; Design of tension and compression members by WSD and LFD methods; Design of beam, beam-columns; Joint design.

Reference Books:

1. Charles G. Salmon, Steel Structures : Design & Behavior.
2. William T. Segui., Steel Design.

CE 432: Environmental Engineering Lab II
1.5 credits, 3hrs/week

Design of sewerage systems; Field visits/assignments on existing water supply and sanitation technologies; Case study on user's participation; O & M practices and ownership; Community managed projects.

CE 437: Solid Waste Management
2.0 credits, 2hrs/week

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; Community and municipal collection systems; Transfer stations and transport; Recycling, reuse and resources recovery; Treatment methods: composting, incineration etc; Landfills; Integrated solid waste management; Hazardous waste management.

Reference Books:

1. P. Jayarama Reddy, *Municipal Solid Waste Management*
2. Jagbir Singh, *Solid Waste Management*
3. Surendra Kumar, *Solid Waste Management*
4. K. M. Nurul Huda, *Municipalsolid waste management*

CE 431: Environmental Engineering III
2.0 credits, 2hrs/week

Ground water exploration and problems; Aquifer properties and groundwater flow; Well hydraulics and well design; Common water supply systems with specific reference to Bangladesh; Different types of hand pumps; Installation and O & M of hand pumps; Problems in water supply; Alternative water supply technologies for problematic areas in Bangladesh.
Water collection and intake; Water transmission and distribution system; Analysis and design of distribution network; Pressure conduits; Fire hydrants; Leak detection; Unaccounted loss of water. Small-scale iron and arsenic removal units, arsenic mitigation in Bangladesh. Socio-economic aspects of water supply and sanitation.

Reference Books:

1. Satinder Ahuja, *Handbook of Water Purity and Quality*
2. M. Feroze Ahmed, Md Mujibur Rahman, *Water* supply & sanitation
3. George Tchobanoglous, Franklin L. Burton, H. David Stensel, *Wastewater Engineering: Treatment and Reuse*
4. Petr Hlavinek, Cvetanka Popovska, Ivana Mahrikova, *Risk Management of Water Supply and Sanitation Systems*
5. Robin Turrell, *Urban Water Supply and* Sanitation

CE 435: Environmental Development Project
2.0 credits, 2hrs/week

Environment and sustainable development; Environmental policies, legislation and act; 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; Special topics.

Reference Books

1.Dixon, John A, Economic Analysis of Environmental impacts of Development Projects.

2. B.C. Punmia; Ashok Kumar Jain; Arun Kumar Jain, Building Construction

3. K. K. Chitkara, Construction project management

CE 442: Geotechnical Engineering Lab II
1.5 credits, 3hrs/week

Interpretation of soil test results and design of foundations.

CE 441: Geotechnical Engineering III
2.0 credits, 2hrs/week

Types of foundation, Foundation engineering report and selection of foundation; Design of footings (spread footings and special footings), mat foundations; Pile foundations; Caissons, Sheet-piling wall; Introduction to Cofferdams, machine foundations and soil improvement techniques.

Reference Books:

1. Barja M. Das, *Foundation Engineering*
2. B.C. Punmia, *Soil Mechanics & Foundation*
3. P.C. Varghese, *Foundation Engineering*
4. Robert Wade Brown, *Practical Foundation Engineering Handbook*
5. Frank Fahy, Foundations of engineering acoustics
6. Mark Thomas Holtzapple & W. Dan Reece, *Foundations of engineering*
7. Braja M. Das, *Principles of Geotechnical Engineering*

CE 443: Geotechnical Engineering IV
2.0 credits, 2hrs/week

Retaining walls, Cofferdams, Pier and abutments; Piles subjected to lateral loads; Analysis and design of machine foundation, Dewatering and slurry wall construction, soil improvement techniques.

Reference Books:

1. B.C. Punmia, *Soil Mechanics & Foundation*
2. Robert Wade Brown, *Practical Foundation Engineering Handbook*
3. Frank Fahy, *Foundations of engineering acoustics*
4. Braja M. Das, *Principles of Geotechnical Engineering*
5. B.C. Punmia, *Soil Mechanics & Foundation*

CE 445: Geotechnical Engineering V
2.0 credits, 2hrs/week

Introduction to critical state soil mechanics, SHANSEP and stress path methods; One, two and three dimensional consolidation problems; Pore pressure coefficients; Soil structure-interaction; Earthquake and liquefaction problems; Numerical solution of geotechnical engineering problems.

Reference Books:

1. B.C. Punmia, *Soil Mechanics & Foundation*
2. Barja M. Das, *Principal of Geotechnical Engineering*
3. Barja M. Das, *Foundation Engineering*

CE 447: Geotechnical Engineering VI
2.0 credits, 2hrs/week

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

Reference Books:

1. B.C. Punmia, *Soil Mechanics & Foundation*
2. Barja M. Das, *Principal of Geotechnical Engineering*
3. Barja M. Das, *Foundation Engineering*

CE 454: Transportation Engineering Lab II
1.5 credits, 3hrs/week

Design of flexible and rigid pavements for highways and airfield pavements; Geometric design; Roadway intersections design, roadway capacity calculation; Traffic studies and design.

CE 451: Transportation Engineering III
2.0 credits, 2hrs/week

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

Reference Books:

1. B.L. Gupta, *Roads, Highway, Railway & Harbour Engineering*.
2. Ashok Kumar Jain, Urban *transport*: *planning and management*
3. S. B. Sehgal, K. L. Bhanot, *A text book on highway engineering*
4. James H. Banks, *Introduction to transportation engineering*
5. Coleman A. O'Flaherty, *Transport planning and traffic engineering*

CE 455: Transportation Engineering IV
2.0 credits, 2hrs/week

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.

Reference Books:

1. B.L. Gupta, *Roads, Highway, Railway & Harbour Engineering*.
2. Khanna, *Highway Engineering.*
3. Ashok Kumar Jain, Urban *transport*: *planning and management*
4. S. B. Sehgal, K. L. Bhanot, *A text book on highway engineering*
5. James H. Banks, *Introduction to transportation engineering*
6. Coleman A. O'Flaherty, *Transport planning and traffic engineering*

CE 457: Transportation Engineering V
2.0 credits, 2hrs/week

Highway needs study; Highway planning, economics and financing; Evaluation and analysis of transportation projects; Management, monitoring, organization and implementation of transportation projects; Selected case studies; Traffic engineering administration and legislation; Urban public transportation and freight movement.

Reference Books:

1. B.L. Gupta, *Roads, Highway, Railway & Harbour Engineering*.
2. Khanna, *Highway Engineering*
3. Sing, *Highway Engineering*

4. Ashok Kumar Jain, Urban *transport*: *planning and management*
5. S. B. Sehgal, K. L. Bhanot, *A text book on highway engineering*
6. James H. Banks, *Introduction to transportation engineering*
7. Coleman A. O'Flaherty, *Transport planning and traffic engineering*

CE 474: Water Resources Engineering Lab II
1.5 credits, 3hrs/week

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

CE 475: River Engineering
2.0 credits, 2hrs/week

The 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, bedforms and flow regimes.

Reference Books:

1. Pavel Novák, C. Nalluri, *Hydraulic Structures*
2. Larry W. Mays, *Hydraulic design handbook*
3. R. M. Khatsuria, *Hydraulics of Spillways and Energy Dissipators*
4. Challa Satya Murthy, *Water resources engineering: principles and practice*

CE 477: Coastal Engineering
2.0 credits, 2hrs/week

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

Reference Books:

1. Robert M. Sorensen, Basic Coastal Engineering
2. David Blank, Introduction to naval Engineering

CE 479: Hydraulic Structures
2.0 credits, 2hrs/week

Design principles of hydraulic structures, types of hydraulic structures; Design of dams, barrages, weirs, spillways, energy dissipaters and spillway gates; Cross drainage works.

Reference Books:

1. S K Agrawal, *Fluid Mechanics & Machinery*
2. R.K. Bansal, *A Text Book of Fluid Mechanics and Hydraulic Machines*
3. R.K. Rajput, *Fluid Mechanics & Hydraulic Machines*
4. Pavel Novák, C. Nalluri, *Hydraulic Structures*
5. Larry W. Mays, *Hydraulic design handbook*
6. R. M. Khatsuria, *Hydraulics of Spillways and Energy Dissipators*
7. Challa Satya Murthy, *Water resources engineering: principles and practice*
8. Mushtaq Ahmad (Ph.D.), *Hydraulics of structures on permeable erodible foundations*

CE 473: Ground Water Engineering
2.0 credits, 2hrs/week

Groundwater in the 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 pollution and contaminant transport; Recharge of groundwater; Saline water intrusion in aquifers; Ground water management.

Reference Books:

1. P.J. Reddi, *Ground Water*
2. H.M. Raghunath, *Ground Water*
3. Jacques W. Delleur, *The Handbook of Groundwater Engineering*
4. William Clarence Walton, *Principles of Groundwater Engineering*

MATH 1103: Basic Mathematics
0 credits, 3hrs/week

Number Systems: Natural Numbers; Fractional Numbers; Rational Numbers; Fundamental Operation on Rational Numbers; Irrational Numbers; Real Numbers; Modulus of Real Numbers; Imaginary Number; Complex Numbers.

Functions and Graphs: Functions; Domain and Range of a Function; Types of Functions; Graph of Functions; Composition of Functions.

Geometry: Coordinates; Straight Lines; Circle; Conics.

Trigonometry: Trigonometric Ratios; Relation between Trigonometric Ratios; Ratios of Angles in the Quadrant; Trigonometric Ratios of Compound Angles; Relations between the Sides and Angles of a Triangle.

Differential Calculus: Limit; Continuity; Differentiation; Successive Differentiations; Maxima and Minima of Functions.

Integral Calculus: Indefinite Integrals; Method of Substitutions; Integration by Parts; Integration of special Trigonometric Functions and Rational Functions; Definite Integrals.

Books Recommended:

1.	P. Abbott and M. E. Wardle	**:**	Trigonometry
2.	Afsaruzzaman	**:**	Intermediate Geometry and Calculus
3.	Shanti Narayan	**:**	Differential Calculus