University of Information Technology and Sciences (UITS),
DHAKA

COURSE CURRICULUM
for
UNDERGRADUATE STUDIES

2nd Edition

Department of Civil Engineering

March, 2020

Department of Civil Engineering
University of Information Technology and Sciences (UITS)
Dhaka, Bangladesh.

Editorial Committee:

Professor Dr. Md. Mazharul Hoque
Dean, School of Science and Engineering, UITS
Ms. Aysha Akter
Head, CE, UITS
Md. Tarikul Islam
Assistant Professor, CE, UITS
Preetom Kishore Roy
Assistant Professor, CE, UITS

PREFACE

(All praises to Almighty Allah-the Most Benevolent and Merciful)

We are extremely delighted to introduce the 2nd edition of course curriculum required for the B.Sc. in Civil Engineering Degree at the University of Information Technology and Sciences (UITS). This is the updated edition entirely accomplished with the utmost care of the Faculties of the Department of Civil Engineering, UITS.

The updated feature of this Curriculum continues the Philosophy of the much needed delivery of the quality Outcome-Based-Education (OBE) in the Civil Engineering Program. The Curriculum has been significantly updated taking into considerations of the extensive discussions with all the stakeholders and has been vetted by renowned Curriculum specialists and senior academicians of BUET and other reputed universities. The UITS Institutional Quality Assurance Cell (IQAC) has been instrumental in the preparation of this comprehensive document. This booklet contains essential components of OBE Curriculum and includes updated rules and regulations for offering the courses, course requirements, missions-visions of the University and the Civil Engineering Department, list of Courses along with synopsis of individual Courses, Course Outcomes (COs) linking with Program Outcomes (POs), and Course Curriculum mapping.

We wish to take the opportunity to thank our excellent group of voluntary Editorial Board Members who have devoted their best and untiring efforts to modify and update the course curriculum. We would also like to convey our sincere gratitude to the internal and external Peer Reviewers, the Team of Experts from BUET and other reputed universities who have provided their invaluable suggestions in preparing the 2nd edition of Curriculum. It is expected that the Curriculum will be kept under review process on a regular basis to meet the demand and requirements of the society, country and local and international accreditation bodies.

As with the practice of any Course System guided by UGC, it is likely that some of the rules and regulations published in this booklet may be modified in future, if needed. Students are, therefore, strongly advised to be in touch with their Head, Coordinators, and Faculty members regarding modifications, if any, which may be introduced by the University at a later stage. It is expected that the booklet will be a very useful guide to the Faculties, Coordinators, and undergraduate students of the Department of Civil Engineering.

Ms. Aysha Akter
Head
Department of Civil Engineering

TABLE OF CONTENTS

Chapter I

General Information

1.1 HISTORICAL BACKGROUND

University of Information Technology and Sciences, abbreviated as UITS, is the first IT based institution for the study of Engineering, Pharmacy, Business, Law, Literature and Social Sciences in Bangladesh. University of Information Technology and Sciences (UITS), the first IT-based private The University was founded in 7 August 2003 as a non-profit organization. **Information Sciences and Technology Solution Ltd. (ISTS)**, a concern of PHP group headed by Alhaj Sufi Mohamed Mizanur Rahman, is the sponsor of UITS. The guiding spirit behind the endeavor is "Divine blessings, mixed with hard work, backed by good intentions, can make miracles." The government was pleased to accord permission with effect from 07 August 2003 to function this University as per its Vision, Mission, Goals and Commitment to low cost Quality Education with moral, ethical and social values with a view to shape a complete, effective and efficient humane power. It endeavors to remain at the cutting edge of building knowledge and skills, integrated with human values and ethical practices in Bangladesh. It is a science and technological knowledge-based center of excellence that provides marketable skills for younger generations who may be gainfully employed both national and international organizations. The Department of Civil Engineering was opened in 2012 and with the approval of University Grant Commission (UGC), Bangladesh, is now the largest department with about 700 undergraduate students. The UITS campus is situated in the prominent area of the city of Dhaka. The physical expansion of the University over the last few years has been remarkably impressive with construction of new academic building, administrative building, auditorium complex, teachers' and students' lounges, and playground etc.

1.2 ACADEMIC ACTIVITIES

Undergraduate courses in the School of Science and Engineering usually extend over four years and lead to a B.Sc. Engineering Degree in Civil, Electrical and Electronic, Computer Science and Engineering, and Information Technology, and Bachelor of Pharmacy. Postgraduate studies and research have not been started in the Department of Civil Engineering but it will be among the primary functions of this University in near future. In addition, the University undertakes research programme sponsored by UITS and other outside organizations, e.g. WaterAid, CIPRB, University Grants Commission (UGC). The expertise of the University teachers and the laboratory facilities of the University are also utilized to solve problems of and to provide up-to-date engineering and technological knowledge to the various organizations of the country. The University is persistent in its effort to improve its research facilities, staff position and courses and curricula to meet the growing technological challenges confronting the nation.

1.3 SCHOOLS AND TEACHING DEPARTMENTS

The University has ten teaching Departments under three Schools. All Departments offer degree programmes; however, some of them offer postgraduate (PG) degrees only. School wise list of the Departments with the status of the degrees offered is given below:

School of Science and Engineering

Department of Civil Engineering:	UG
Department of Electrical and Electronic Engineering	UG and PG
Department of Electronic and Communication Engineering	UG
Department of Computer Science and Engineering:	UG and PG
Department of Information Technology	UG
Department of Pharmacy	UG

School of Business

Department of Business Studies	UG and PG

School of Liberal Arts and Social Science

Department of English	UG and PG
Department of Social Work	UG and PG

School of Law

Department of Law	UG

UNIVERSITY ADMINISTRATION

Vice Chancellor: Professor Dr. Mohammed Solaiman
Treasurer: Professor Dr. Siraj Uddin Ahmed

List of Administrative Officers

Registrar: Mohammad Kamrul Hasan
Controller of Examinations: Professor A. N. M. Shareef
Director of Students Welfare: Professor Dr. Nazrrul Islam
Librarian: Mr. Md. Anwar Hossain

Deans of Schools

Dean of School of Science and Engineering: Professor Dr. Md Mazharul Hoque
Dean of School of Business Studies: Professor Dr. Mohammad Shahidul Islam
Dean of School of Liberal Arts and Social Science: Dr. Arifatul Kibria

Chapter 2

The Department of Civil Engineering

2.1 INTRODUCTION

The Department of Civil Engineering comprises of four major divisions: Environmental and Water Resources Engineering, Geotechnical Engineering, Structural Engineering, and Transportation Engineering. The divisions offer basic and advanced optional courses in the above discipline. Research on the above fields is extremely important in the national context. These include areas like behavior of available building and road materials with emphasis on indigenous materials, engineering soil properties of various regions of the country, low-cost cyclone resistant housing, seismic zoning of Bangladesh, waste management, environmental pollution control, environmental impact assessment, traffic simulation, transport system modeling, traffic safety studies, etc. Some research projects of more fundamental nature viz. application of finite element techniques in tackling engineering problems, dynamic behavior of multistoried buildings, soil-structure interaction, concrete technology etc. pursued in this Department have greatly contributed to advancement of knowledge. To meet the national demand, the division of Environmental and Water Resources Engineering trains engineers specializing in hydrology, hydraulics, rain water harvesting, salinity intrusion, irrigation, drainage, flood control, land reclamation, bank protection, river stabilization, ground water, sedimentation problems and coastal engineering.

The course curriculum has been prepared following the requirements of Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh and has been assessed by the curriculum Specialists of the Department of Civil Engineering, BUET. Strength lies with 24 full time faculties with degrees mostly from BUET and other country like Australia.

2.2 LIST OF FACULTY MEMBERS OF DEPARTMENT OFCIVIL ENGINEERING

<table>
<tr><td rowspan="3">  </td><td colspan="2">Ayesha Akhter
Assistant Professor</td></tr>
<tr><td>aktera73@yahoo.com
01716110933</td><td rowspan="2">Research Interests:
Study on coastal erosion of Bangladesh.

Protective measures for coastal zone.

Artificial beach nourishment
Investigate breakwater hydrodynamic performance for coastal defense.</td></tr>
<tr><td>M.Sc in Water Resources Engineering, Bangladesh University of Engineering and Technology (BUET).
B.Sc in Water Resources Engineering, Bangladesh University of Engineering and Technology (BUET)</td></tr>
</table>

<table>
<tr><td rowspan="3">  </td><td colspan="2">Prof. Dr. Md. Mazharul Hoque
Professor& Dean</td></tr>
<tr><td>dirarc@gmail.com

01715-007791</td><td rowspan="2"><u>Research Interests:</u>
Road safety; Accident investigation; Road traffic system; Traffic management; Public transportation planning and evaluation; Transport Economics, Non-motorised transport, Traffic Engineering and Design, Environmental Issues; Project Planning and Management.</td></tr>
<tr><td>Ph.D., Monash University, Australia (Transportation Engineering)
Post Doctoral(from Visiting Card)
M.Engg., AIT, Thailand
B.Sc.Engg. (Civil), BUET</td></tr>
</table>

<table>
<tr><td rowspan="3">  </td><td colspan="2">Preetom Kishore Roy
Assistant Professor</td></tr>
<tr><td>preetom.kishore@uits.edu.bd

01717-832289</td><td rowspan="2"><u>Research Interests:</u>
Arsenic removal mechanism by adsorption-desorption capacity of nanoparticles

Nanoparticle characterization

Rainwater harvesting
Sustainable house technologies, E-waste management</td></tr>
<tr><td>Grad Cert Course (2012) - University of Technology, Sydney, Australia.
MSc- Bangladesh University of Engineering and Technology (BUET).
BSc- Military Institute of Science and Technology, University of Dhaka.</td></tr>
</table>

<table>
<tr><td rowspan="3">  </td><td colspan="2">MahfuzIbnMannan
Assistant Professor</td></tr>
<tr><td>mahfuz.mannan@uits.edu.bd

01720016111</td><td rowspan="2"><u>Research Interests:</u>
Econophysics
Actuarial Mathematics
Statistical Physics</td></tr>
<tr><td>M.S, University of Dhaka
B.Sc. (Hon's), University of Dhaka</td></tr>
</table>

SarabanTahora

Assistant Professor

sarabantahora@gmail.com

Ph.D. (Fellow), Department of Mathematics, University of Dhaka
M.S. (Thesis), Applied Mathematics, Department of Mathematics, University of Dhaka
B.Sc (Four years Hons.), Mathematics, Department of Mathematics, University of Dhaka

Research Interests:

Project Work: Lattice of Fuzzy Numbers
Thesis Work: Manifolds with Cohomology and Riemannian Geometry

Md. Tarikul Islam

Assistant Professor

tarikbuet9@gmail.com,
tarikul.islam@uits.edu.bd

01706543604

B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET)

Research Interests:

RCC & Composite Structures, Structural Safety.

Urban Rainwater Harvesting System.

Decentralized Wastewater Management System.

Database Management and Administration

KamrunNaher Khan Mukti

Assistant Professor

mukti.ju@gmail.com,
kamrun.nahar@uits.edu.bd

01717-903747

Masters of Science (M Sc) in Geography & Environment-Jahangirnagar University (JU).
Bachelor of Science (B Sc) in Geography & Environment-Jahangirnagar University (JU)

Research Interests:

Water Pollution and its control

GIS and Remote Sensing

Landuse change

Physiography

Md. Hasan Imam

Assistant Professor

imamce03@gmail.com,
hasan.imam@uits.edu.bd

01814-500523

B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET)

Research Interests:

Structural Dynamics and Earthquake Engineering

Foundation Engineering, sustainable structure strengthening of materials by FRP, Structural rehabilitation
Concrete technology (bendable concrete)

PinkiDatta

Lecturer

pinki.datta@uits.edu.bd

01686879319

B.Sc.(4-years Hon's)Statistics-, Jahangirnagar University.
M.S(1-year)Statistics, Jahangirnagar University.

Research Interests:

MaqsudaHaque

Lecturer

mhsatu@yahoo.com
01915-878030

B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET)

Research Interests:

Behavior of Deep Beams

Structural Engineering
Structural Dynamics
Cost-Effective and safe Structures.

Mohiuddin Ahmed

Lecturer

mohiahmed22@gmail.com,
mohiuddin.ahmed@uits.edu.bd

01716-605452

B.Sc. in Civil Engineering, University of Information Technology & Sciences (UITS).
M.Sc. in Structural Engineering (Ongoing), Bangladesh University of Engineering and Technology (BUET).

Research Interests:

Concrete Structures
Analysis and Design

Bridge Analysis and Design

High Rise Building Design

Cost Effective Structures

Md.SanullahShamim

Lecturer

sanaullah.shamim.bd@gmail.com,
sanaullah.shamim@uits.edu.bd

01927955653

M.Sc in Civil Engineering, BUET (Ongoing).
Bachelor of Science in Civil Engineering, Rajshahi University of Engineering & Technology (RUET).

Research Interests:

Pavement Design

Traffic Engineering

Soil dynamics

Soil improvement

Abdullah Al NurAshek

Lecturer

abdullah.ashek@uits.edu.bd

01521493660

M.Sc in Civil Engineering, BUET (Ongoing).
B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).

Research Interests:

Pavement Design
ITS

Transportation Planning
Traffic Engineering

	**Subrata Roy** Lecturer tutulroy110@gmail.com 01535118701 M.Sc in Civil Engineering, Bangladesh University of Engineering and Technology (BUET) (Ongoing). B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests* Pavement Design Pavement management Transportation Economics Highway Materials
	**Fahima Akter** Lecturer fahima.priya@uits.edu.bd 01838769559 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests*
	**Md. Fahim Azraf Khan** Lecturer fahim.azraf@uits.edu.bd 01670281562 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests* Engineering materials,coastal infrastructure, curing in adverse condition

	**Md. Nurul Islam Nahed** Lecturer nurul.islam@uits.edu.bd 01775632366 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests*

	**Md.Rakib Hasan Faisal** Lecturer rakib.hasan@uits.edu.bd 01752346767 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests* Transportation Planning, Pavement Management, Transport Economics, Sustainable development,

	**Saifa Anzum Prioty** Lecturer saifa.anzum@uits.edu.bd +8809678008487 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests*

	**Md. Delowar Hossain** Lecturer delowar.hossain@uits.edu.bd +8809678008487 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests*

	**Mahfuzur Rahman** Lecturer mahfuzur.rahman@uits.edu.bd +8809678008487 M.Sc. in Civil Engineering (On-going) Islamic University of Technology (IUT) B.Sc. in Civil Engineering, Islamic University of Technology (IUT)	*Research Interests*

	**Tamim Bin Zahid** Lecturer Tamim.zahid@uits.edu.bd +8809678008487 B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	*Research Interests*

I 	**Shairin Islam** Lecturer	*Research Interests*
	shairin.islam@uits.edu.bd +8809678008487	
	B.Sc. in Civil Engineering, Bangladesh University of Engineering and Technology (BUET).	

Chapter 3

Rules and Regulations for Course System

The following are the rules and regulations for administering undergraduate course curriculum through the course system. The following articles have been reproduced from R*ules and Regulations for Course System*.

Rules, Regulations, Course Offering Evaluation and Grading

1. Organizational Framework of the Bachelor's Degree Programs of the Course System

The undergraduate curriculum at University of Information Technology and Sciences (UITS) is based on the course system. The salient features of the course system are:

(i) Reduction of the number of theoretical courses and examination papers to around five in each term,
(ii) The absence of a pass or a fail on an annual basis,
(iii) Continuous evaluation of student's performance,
(iv) Introduction of some additional optional courses and thus enable students to select courses according to his/her interest as far as possible
(v) Introduction to supplementary examination for not more than 2 in each semester
(vi) The flexibility to allow the student to progress at his/her own pace depending on respective ability or convenience, subject to the regulations on credit and minimum Grade Point Average(GPA) requirements, and
(vii) Promotion of teacher-student contact.

In the curriculum for the undergraduate programs, besides the professional courses pertaining to each discipline, there is a strong emphasis on acquiring a thorough knowledge in the basic sciences of Mathematics, Physics and Chemistry. Due importance is also given for the study of several subjects in Humanities and Social Sciences which, it is expected will help the student to interact more positively with the society. Thus, the course contents of the undergraduate programs provide a harmonious blend of basic sciences and their applications as well as their social relevance. The first two terms of Bachelor's Degree programs consist of courses in basic sciences, mathematics, humanities and social sciences, basic engineering and architecture subjects. The third and subsequent terms build directly on the knowledge of the basic subjects gained in the first two terms and go on to develop competence in specific disciplines.

2. Student Admission

Students will be admitted in undergraduate curriculum in the Departments of Civil Engineering, as existing rules of the University. The Registrar's Office will continue to serve as Admissions Office and the Department will deal with course registration in addition to student admission.

3. Number of Terms in a Year

There will be two semesters (Spring and Autumn) in an academic year.

The duration of each of Spring (Jan-Jun) and Autumn (Jul-Dec) will be 18 weeks which will be used as follows:

Classes	*15 weeks*	
Term-final examination (including Preparatory leave and intervals between successive exams).	*3 weeks*	
	Total	*18 weeks*

4. Course Pattern and Credit Structure

The entire undergraduate program is covered through a set of theoretical and laboratory/ sessional/ design courses.

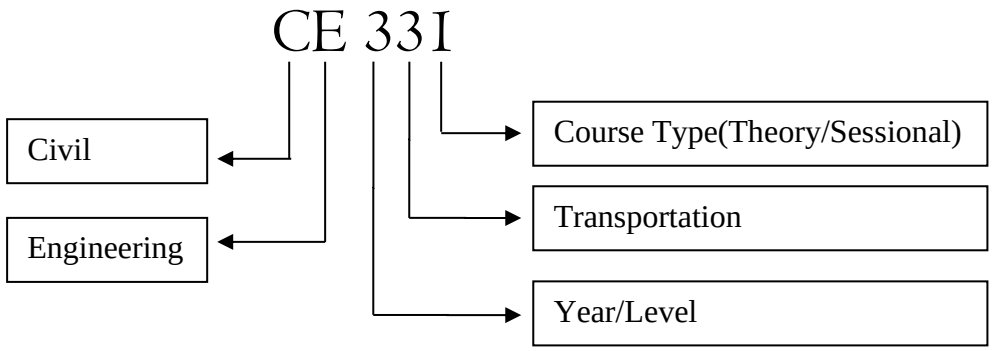
4.1 Course Designation and Numbering System

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

(a) The first digit will correspond to the year/level in which the course is normally taken by the students.

(b) The second digit will be reserved for Departmental use for such things as to identify different areas within a Department. For example, '1' stands for Environmental Engineering, '2' stands of Geotechnical Engineering, '3' stands for Transportation Engineering, '4' stands for Water Resources Engineering and '5' & '6' stand for Structural Engineering.

(c) The last digit will usually be odd for theoretical and even for laboratory or sessional courses.



4.2 Assignment of Credits

(i) Theoretical Courses
One lecture per week per semester will be equivalent to one credit

(ii) Laboratory/ Sessional/ Design
Credits for laboratory/sessional or design courses will be half of the class hours per week per semester

Credits are also assigned to project and thesis work taken by students. The amount of credits assigned to such work may vary from discipline to discipline.

The curriculum does not demand the same rate of academic progress from all students for obtaining the degree but only lays down the pace expected from a normal student. A student whose background or capacity for assimilation is lower will be permitted to complete the program at a slower pace by studying less number of courses during a given semester (subject to a minimum course load). He may keep pace with his class by taking those courses in the following semesters which he had dropped during the regular semesters, or by covering the entire degree program over an extended period without developing any feeling of inferiority complex.

5. Types of Courses

The courses included in undergraduate curricula are divided into several groups as follows:

5.1 Core Courses

In each discipline a number of courses will be identified as core courses which form the nucleus of the respective bachelor's degree program. A student has to complete all of the designated core courses for his discipline.

5.2 Pre-requisite Courses

Some of the core courses are identified as pre-requisite courses. A pre-requisite course is one which is required to be completed before some other course(s) can be taken. Any such course, on which one or more subsequent courses build up, may be offered in each of the two regular semesters.

5.3 Optional Courses

Apart from the core courses, students will have to complete a number of courses which are optional in nature in that students will have some choice to choose the required number of courses from a specified group/ number of courses.

6. Course Offering and Instruction

The courses to be offered in a particular semester will be announced and published in the course catalogue along with a tentative semester schedule before the end of the previous term. Whether a course is to be offered in any semester will be decided by the department. The department may arrange to offer one or more prerequisite or core courses in any semester depending on the number of students who dropped or failed the course in the previous semester. Each course is conducted by a teacher. The course teacher is responsible for maintaining the expected standard of the course and for the assessment of student's performance.

7. Departmental Course Curriculum Committee

Consistent with its resilient policy to keep pace with new developments in the field of science and technology, the university will update its course curriculum at frequent intervals. Such updating aims not only to include the expanding frontiers of knowledge in the various fields but also to accommodate the changing social, industrial and professional need of the country. This can be done through deletion and modification of some of the courses and also through the introduction of new ones. The department will constitute a departmental course curriculum committee with three teachers of the department. This committee will assess and evaluate the performance of the course system within the department. In addition to the discussion with other teachers of the department, the committee may also propose any

changes and modifications needed for upgrading the undergraduate curriculum and the course system from time to time to the Academic and Planning Committees of the Department.

8. Teacher Student Contact

The proposed system encourages students to come in close contact with teachers. For promotion of teacher-student contact, each student is assigned to adviser/batch coordinator and the student is free to discuss with his batch coordinator all academic matters, especially those related to courses taken and classes being attended by him. Students are also encouraged to meet with other teachers any time for help on academic and extra-curricular matters.

9. Student Adviser/Batch Coordinator

One adviser/batch coordinator would normally be appointed for a batch of student in the department who will advise each student on the courses to be taken by the student. The batch coordinator will discuss with the student on his/her academic program and then decide the number and nature of courses for which he/she can register. However, it is the student's responsibility to keep contacts with his batch coordinator who will review and eventually approve the student's specific plan of study and check on subsequent progress. The batch coordinator will advise the students to register for the courses during the next semester within the framework of the guidelines in respect of minimum/maximum credit hours limits, etc. which is elaborated at appropriate places in this report. The batch coordinator is also authorized to permit the student to drop one or more courses based on his/her academic performance and the corresponding categorization.

10. Registration Requirements

Any student who makes use of class room or laboratory facilities or faculty time is required to register formally. Being admitted to the university, each student is assigned to a batch coordinator. The student can register for courses he intends to take during a given term only on the basis of the advice and consent of his/her coordinator.

10.1 Registration Procedure

Students must register for each class in which they want to participate in consultation with his/her coordinator. This can be done online within a specified deadline at http://ucam.uits.edu.bd where a student can select courses in the online course registration form. The student is then required to meet his/her coordinator to finalize and confirm the registration. Much counseling and advising is accomplished at the registration time. It is absolutely necessary that all students register at the specified time.

10.2 Limits on the Credit Hours to be taken

A student must be enrolled in at least 12 credit hours. He may be allowed to enroll in up to a maximum of 24 credit hours if recommended by his/her adviser. A student must enroll for the prescribed sessional/laboratory courses in the respective semester within the allowed credit-hour limits. In special cases where a student cannot be allotted the minimum required 12 credit hours in a semester, the department may approve a lesser number of credit hours to suit individual requirements.

10.3 Pre-condition for Registration

Some courses involve pre-requisite courses. Students will be allowed to register in those courses subject to the satisfaction of prerequisite courses. If a student fails in a pre-requisite course in any semester, the department may allow him to register for a course which builds on the pre-requisite course provided his/her attendance and grades in continuous assessment in the said pre-requisite course is found to be satisfactory.

Registration will be done at the beginning of each term. The Registration program with dates and venue will be announced in advance. Late registration is, however, permitted within the deadline after starting the classes on payment of a late registration fee. Students having outstanding dues to university shall not be permitted to register. All students have, therefore, to clear their dues and get a clearance or no dues certificate, on the production of which, they will be given necessary permission to complete the course registration procedure. For the first year students, prior department-wise enrolment/admission is mandatory. A departmental pre-orientation program will be conducted for them at the beginning of the first semester when they will be handed over the registration package on producing enrollment slip/proof of admission.

10.4 Pre-registration

At this moment there is no pre-registration system at the department.

10.5 Registration Deadline

Student must register for the courses to be taken before the commencement at a due date in each semester and no late registration will be accepted after last date of registration. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar through the concerned Head and can document circumstances such as medical problems (physically incapacitated and not able to be present) from a Medical Officer of a Hospitals.

10.6 Penalty for Late Registration

Students who fail to register during the designated date for registration are charged a late registration fee. This extra fee will not be waived whatever be the reason for late registration.

10.7 Course Adjustment Procedure

A student will have some limited options to Add or delete & dropping courses from his/her registration list within the first few weeks from the beginning of the class. However, minimum credit requirements mentioned in the article 10.2 need to be fulfilled after the adjustments. He/She may add courses only within the first few weeks of a regular semester. In case of dropping a course a student will be allowed to do so within these weeks after the commencement of a regular semester. Adjustment of initially registered courses in any semester can be done.

Any student willing to add or drop courses will have to fill up a form in consultation with and under the guidance of his/her coordinator. The original copy of the form will be submitted to the Registrar's Office, and then the requisite number of photo copies will be made by the Registrar's Office for distribution to the concerned batch coordinator, Head, Dean and the student.

All changes in courses must be approved by the batch coordinator and the Head of the department concerned. The form will have to be submitted to the Registrar's Office after duly filled in and signed by the concerned persons. To add/drop a course respective teacher's consent will be required. Late Registration Fee is not necessary in these cases.

10.8 Withdrawal from a Semester

Withdrawal from any semester will be granted on the basis of the discussion with the coordinator and Head of the department.

11. The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory courses this continuous assessment is made through a set of quizzes/in class evaluation, class participation, homework assignments (if any), and a semester final examination. The assessment in laboratory/sessional courses is made through observation of the student at work in class, viva-voce during laboratory hours, and quizzes. As discussed earlier, each course has a certain number of credits which describe its weightage.A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has completed satisfactorily and the weighted average of the grade points that he/she has maintained. A minimum grade point average is required to be maintained for satisfactory progress. Also a minimum number of earned credits should be acquired in order to qualify for the degree as prescribed.

Letter grades and corresponding grade-points will be awarded in accordance with provisions shown below:

Numerical grade	Letter Grade	Grade Point
80% or 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
Continuation (for project & thesis / design courses)	X	----

11.1 Distribution of Marks

Thirty percent (30%) of marks shall be allotted for continuous assessment i.e., quizzes, class tests and homework assignments, in class evaluation and class participation. The remainder of the marks will be allotted to SEMESTER FINAL Examination which will be conducted centrally by the University. There will be internal and external examiners for each course in the term Final Examination. The duration of each semester final examination will be 3 hours. The distribution of marks for a given course will be as follows:

(i)	Class Attendance	10%
(ii)	Class Test/ Class Assessment	20%
(iii)	Final Examination (3 hours)	70%
	Total	100%

Basis for awarding marks for class participation and attendance is generally as follows:

Attendance	Marks
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
Less than 60%	0

"The Class Test/ Class Assessment Marks may comprise of Class Tests and Assignments. The Number of Class Tests of a course shall be at lease 'N+1', where 'N' is the number of credits of the course. Evaluation of the performance in Class Tests will be on the basis of the best 'N' Class Tests."

For 2 credit courses 2 best out of 3, for 3 credit courses 3 best out of 4, and for 4 credit courses 4 best out of 5class tests may be considered for awarding grade. These may be considered as the minimum recommended number of class tests for any course.

12. Earned Credits

The courses in which a student has obtained `D' or a higher Grade will be counted as earned credits. Any course in which a student has obtained `F' grade will not be counted as earned credits. A student who obtains an `F' grade in any course in any term, will have to repeat the course. If a student obtains an `F' grade in an optional course, may choose to repeat the course or take a substitute course if available.

13. Honors

At this moment there is no honors grade point average system in the department.

13.1 Dean's List

As a recognition of excellent performance, the names of students obtaining an average GPA of 3.75 or above in two regular Terms in each academic year may be published in the Dean's List in School of Science and Engineering. Students who have received 'F' grade in any course during any of the two regular terms will not be considered for Dean's List in that year.

14. Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a semester having credits of C1, C2, C3, C4, and C5 and his grade points in these courses are G1, G2, G3, G4, and G5, respectively then

$$\text{GPA/CGPA} = \frac{\sum CnGn}{\sum Cn}$$

Suppose a student got grade point "4.0" in a 3 credit hours course and "3.5" in 1.5 credit hours course then his/her GPA/CGPA will be as follows:

$$\text{GPA/CGPA} = \frac{(3\times4)+(1.5\times3.5)}{3+1.5} = 3.83$$

15. Student Classification

For a number of reasons it is necessary to have a definite system by which to classify students as First Year, Second Year/, Third Year, and Fourth Year. At UITS, regular students are classified according to the number of credit hours earned towards a degree. The following classification applies to the students.

16. Registration for the Second and Subsequent Terms

A student is normally required to earn at least 12 credits in a semester. At the end of each semester, the students will be classified into the following two categories:

Category 1

Students who have passed all the courses prescribed for the previous semester and have no backlog of courses. A student belonging to *Category 1*will be eligible to register for all courses prescribed for the next semester.

Category 2

Students who have earned at least 12 credits in the semester but do not belong to *Category 1*.A student belonging to *Category 2* is advised to take one or two backlog courses along with all the courses in the next semester subject to the condition that he/she has to register for such backlog courses as may be prescribed by the batch coordinator.

17. Performance Evaluation

The performance of a student will be evaluated in terms of two indices, viz. semester grade point average, and cumulative grade point average, which is the grade average for all the semesters. The semester grade point average is computed dividing the total grade points earned in a semester by the number of semester hours taken in that semester. The overall or cumulative grade point average (CGPA) is computed by dividing the total grade points accumulated up to date by the total credit hours earned. Thus a student

who has earned 275 grade points in attempting 100 credit hours of courses would have an overall grade point average of 2.75.

18. Academic Progress, Probation and Suspension

Academic Progress: Undergraduate students will be considered to be making normal progress toward a Degree if their cumulative or overall GPA for all work attempted is not less than 2.25.

Probation and Suspension: Undergraduate students who regularly maintain Semester GPA of 2.25 or better are making good progress toward their degrees and are in good standing with the university. Students who fail to maintain this minimum rate of progress may be placed on academic probation.

19. Measures for Helping Academically Weak Students

The following provisions will be made as far as possible to help academically weak students to enable them to complete their studies within the maximum period of six years in engineering:

a) All such students whose cumulative grade point average(CGPA) are less than 2.25 at the end of a semester may be given a load of not exceeding four courses in the next semester.

b) For other academic deficiencies, some basic and core courses may be offered in the next semester in order to enable the student to partially make-up for the backlog courses.

Following criteria will be followed for determining academically weak students:

a) CGPA falling below 2.25.
b) Grade point average (GPA) of a semester falling below 2.25 points below that of previous semester.

20. Special Courses

a) These courses, which include self-study courses, will be from amongst the regular courses listed in the course catalog.

b) Whether a course is to be floated as a special course will be decided by the Head of the department in consultation with the teacher/course co-coordinator concerned if it is required to be offered in the following semesters.

c) The special course may be offered to any student at any semester if it helps students for graduation. It will be offered only if the course is not running in that semester as a regular course.

d) Normally no lecture will be delivered for the special course but laboratory/design classes may be held if they form a part of the course. The course coordinator/course teacher will also assign home works; administer quizzes/class tests and final examination for giving his or her assessments at the end of the semester.

21. Minimum Earned Credit and GPA Requirements for Obtaining Graduation

Minimum credit hour requirements for the award of Bachelor of Science (B.Sc.) Degree in civil engineering will be decided by the respective Degree Awarding Committee of the Department. However,

total 160.0 credit hours for civil engineering must be earned to be eligible for graduation, and this must include the specified core courses.

The minimum Grade Point Average (GPA) requirement for obtaining Bachelor of Science in civil engineering degree is 2.25.

21.I Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for Bachelor's Degree will have to apply to the Controller of Examinations through his/her Head for graduation. Provisional Degree will be awarded on completion of credit and GPA requirements. Such provisional Degrees will be confirmed by the Academic Council.

22. Industrial/Professional Training Requirements

At this moment there is no industrial/professional training requirements for the degree in civil engineering.

23. Credit Transfer Policy

In order to facilitate admission of the students seeking transferring from other universities, the School Committee has recommended the following waiver criteria:

1. The respective Academic/ Planning Committees of the departments will make the decision in regarding course waiver and the amount of course waiver will be fixed by the Academic/ Planning Committees of the department.

2. The course waiver will be extended up to 100% of the courses for student transferring from public and all private universities approved by UGC and Govt. of Bangladesh. And "D" grades will be accepted from any Public University and all private universities approved by the UGC and Govt. of Bangladesh as per the UITS/ UGC grading system.

3. There will be no obligation for maintaining the provision of completing 30% (thirty percent) of the total required credits for the degree.

4. All the grades of the students in other universities will be converted based on the percentage of the marks obtained in those courses as per UGC/ UITS rules.

24. Time Limits for Completion of Bachelor's Degree

A student must complete his studies within a maximum period of six years for civil engineering.

24.I. Inclusion of Repeaters

Repeater students from the old syllabus system will need to take the equivalent courses from the new syllabus system. The irregular/repeater students will be subjected to the following rules and regulations:

1. If the original course in the old syllabus has equivalent courses in the new syllabus

If he/she had received an 'F' or had not registered for the original course before, he/she has to complete the equivalent course as per the new syllabus and the earned credits will be equal to the credit of the equivalent course.

25. Attendance, Conduct, Discipline etc.

25.I Attendance

All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly, and one is required to attend at least 60% of all classes held in every course.

25.2 Conduct and Discipline

A student shall conform to a high standard of discipline, and shall conduct himself, within and outside the precincts of the university in a manner befitting the students of a university of national importance. He shall show due courtesy and consideration to the employees of the university, good neighborliness to his fellow students and the teachers of the university and pay due attention and courtesy to visitors.

To safeguard its ideals of scholarship, character and personal behavior, the university reserves the right to require the withdrawal of any student at any time for any reason deemed sufficient.

26. Absence during Term

A student should not be absent from quizzes, class tests, etc. during the semester. Such absence will naturally lead to reduction in points/marks which count towards the final grade. Absence in Semester Final Examination will result in 'F' grades.

A student who has been absent for short periods, up to a maximum of four weeks due to illness should approach, the course teacher(s) or the course coordinator(s) for make-up quizzes/class tests or assignments immediately on returning to the classes. Such request should be supported by medical certificate from a medical officer of a Hospital.

Chapter 4

Course Requirements for Undergraduate Studies

4.1 INTRODUCTION

The undergraduate students of the Department of Civil Engineering have to follow the course schedule given below. The letter prefix in any course number indicates the Department offering the course viz. CE for Civil Engineering, EEE for Electrical Engineering, CSE for Computer Science and Engineering, CHEM for Chemistry, PHY for Physics, MATH for Mathematics, and GED for General Education. The first digit in the number indicates the year/level for which the course is intended. Odd number courses are theory courses and even numbered courses are sessional courses.

4.2 COURSE REQUIREMENTS

General Education (9.5 Credits)			Credit
1.	GED 101	The Four Skills of Communication in English I	2.0
2.	GED 102	Developing English Language skills lab	1.5
3.	GED 153	Accounting	2.0
Bangla Courses: (Any one)			(2.0X1)=2
4.	GED119	History of the Emergence of Independent Bangladesh (option)	2.0
5.	GED117	Bengali Language and Literature (option)	2.0
6.	GED105	Bangladesh Studies (option)	2.0
Optional Courses : (Any One)			(2.0X1)=2
7.	GED 155	Sociology (option)	2.0
8.	GED 157	Economics (option)	2.0
9.	GED 159	Government (option)	2.0
		Total	**9.5**
Basic Science (12 Credits)			Credit
1.	PHY 175	Physical Optics, Waves and Oscillation, Heat and Thermodynamics	3.0
2.	PHY 177	Structure of Matter, Electricity and Magnetism and Modern Physics	3.0
3.	PHY 176	Engineering Physics Lab	1.5
4.	CHEM 175	Engineering Chemistry	3.0
5.	CHEM 176	Engineering Chemistry Lab	1.5
		Total	**12**
Mathematics (12 Credits)			Credit
1.	MAT 153	Differential and Integral Calculus, Matrices	3.0
2.	MAT 155	Differential Equations and Statistics	3.0
3.	MAT 257	Coordinate Geometry and Vector Analysis	3.0
4.	MAT 259	Fourier Analysis and Laplace Transformation	3.0
		Total	**12.0**
Basic Engineering (44 Credits)			Credit

1.	CE 101	Engineering Mechanics	3.0
2.	CE 103	Surveying	3.0
3.	CE 201	Engineering Materials	3.0
4.	CE 203	Engineering Geology and Geomorphology	3.0
5.	CE251	Mechanics of Solids I	3.0
6.	CE253	Mechanics of Solids II	3.0
7.	CE 241	Fluid Mechanics	3.0
8.	EEE 241	Fundamentals of Electrical Engineering	3.0
9.	CE 209	Numerical Methods and Analysis	2.0
10.	CE106	Practical Surveying	1.5
11.	CSE 252	Computer Programming Lab	1.5
12.	CE 102	Civil Engineering Drawing	1.5
13.	CE 104	Computer Aided Drafting	1.5
14.	CE 108	Workshop Sessional	1.5
15.	CE 202	Details of Construction Lab	1.5
16.	CE 204	Engineering Materials Lab	1.5
17.	CE 206	Quantity Surveying	1.5
18.	CE 208	Structural Mechanics Lab	1.5
19.	CE 242	Fluid Mechanics Lab	1.5
20.	CE 304	Engineering Computation Lab	1.5
21.	CE 302	Remote Sensing and GIS Lab	1.5
		Total	**44**
Structural Engineering (22.5 Credits)			Credit
22.	CE 351	Structural Analysis and Design I	3.0
23.	CE 353	Structural Analysis and Design II	3.0
24.	CE 451	Structural Analysis and Design III	3.0
25.	CE 355	Design of Concrete Structures I	3.0
26.	CE 357	Design of Concrete Structures II	3.0
27.	CE 359	Design of Steel Structures	3.0
28.	CE 360	Steel Structures Design Lab	1.5
29.	CE356	Concrete Structures Design Lab I	1.5
30.	CE 452	Concrete Structures Design Lab II	1.5
		Total	**22.5**
Environmental Engineering (8.5 Credits)			Credit
31.	CE 311	Water Supply Engineering	3.0
32.	CE 313	Waste water and Sanitation Engineering	4.0
33.	CE 314	Environmental Engineering Lab-I	1.5
		Total	**8.5**
Geotechnical Engineering (8.5 Credits)			Credit
34.	CE 321	Principles of Soil Mechanics	4.0
35.	CE 323	Foundation Engineering	3.0
36.	CE 324	Geotechnical Engineering Lab-I	1.5
		Total	**8.5**
Transportation Engineering (8.5 Credits)			Credit
37.	CE 331	Transportation Planning and Traffic Engineering	3.0
38.	CE 333	Pavement Design and Railway Engineering	4.0
39.	CE 334	Transportation Engineering Lab-I	1.5
		Total	**8.5**

Water Resources Engineering (8.5 Credits)			Credit
40.	CE 341	Open Channel Flow	4.0
41.	CE 345	Hydrology, Irrigation Engineering and Flood Management	3.0
42.	CE 342	Open Channel Flow Lab	1.5
		Total	**8.5**
Civil Engineering Practices (10.5 Credits)			Credit
43.	CE 491	Project Planning and Construction Management	3.0
44.	CE 493	Professional Practices, Communication and Ethics	3.0
45.	CE 494	Professional Practices and Communication Sessional	1.5
Optional Courses: Any One			3.0X1=3.0
46.	CE495	Socio-Economic Aspects of Development Projects	3.0
47.	CE498	Business and Career Development	3.0
		Total	**10.5**
Major + Minor (11 Credits) Structural Engineering			
Optional Courses::(Any two theory + one Lab)= (2x2+1.5)			Credit
48.	CE 453	Introduction to Finite Element Method	2.0
49.	CE 455	Prestressed Concrete	2.0
50.	CE 457	Design of Concrete Structures III	2.0
51.	CE 459	Dynamics of Structures	2.0
52.	CE 461	Introduction to Steel-Concrete Composite Structure	2.0
53.	CE 454	Computer Aided Analysis and Design Sessional	1.5
		Total	**5.5**
Environmental Engineering			
Optional Courses :(Any two theory + one Lab)= (2x2+1.5)			Credit
54.	CE 411	Solid and Hazardous Waste Management	2.0
55.	CE 413	Environmental Pollution Management	2.0
56.	CE 415	Environmental and Sustainable Management	2.0
57.	CE 414	Environmental Engineering Lab-II	1.5
		Total	**5.5**
Geotechnical Engineering			
Optional Courses :(Any two theory + one Lab)= (2x2+1.5)			Credit
58.	CE 421	Earth Retaining Structures	2.0
59.	CE 425	Soil Water Interaction	2.0
60.	CE423	Elementary Soil Dynamics	2.0
61.	CE 427	Geotechnical Earthquake Engineering	2.0
62.	CE 424	Geotechnical Engineering Lab-II	1.5
		Total	**5.5**
Transportation Engineering			
Optional Courses:(Any two theory + one Lab)= (2x2+1.5)			Credit
63.	CE 431	Traffic Planning and Management	2.0
64.	CE 433	Pavement Management, Drainage and Airport	2.0
65.	CE 435	Urban Transportation Planning and Management	2.0
66.	CE 434	Transportation Engineering Lab-II	1.5
		Total	**5.5**
Water Resources Engineering			
Optional Courses :(Any two theory + one Lab)= (2x2+1.5)			Credit
1.	CE 443	Ground Water Engineering	2.0

2.	CE 445	River Engineering	2.0
3.	CE 447	Hydraulic Structures	2.0
4.	CE 449	Coastal Engineering	2.0
5.	CE 448	Water Resources Engineering Lab	1.5
		Total	5.5
CE 490 (Project/ Thesis)		4.5 Credit	
Total		160.0 Credits	

4.3 SUMMARY OF COURSE REQUIREMENTS FOR Bachelor of Sciencein CIVIL Engineering DEGREE:

	Courses	Required Credits	Total credits to be offered)
A	General Education	9.5	(17.5)
B	Basic Science	12.0	(12.0)
C	Mathematics	12.0	(12.0)
D	Basic Engineering	44.0	(44.0)
E	Structural Engineering	22.5	(34.0)
F	Environmental Engineering	8.5	(16.0)
G	Geotechnical Engineering	8.5	(18.0)
H	Transportation Engineering	8.5	(16.0)
I	Water Resources Engineering	8.5	(18.0)
J	Civil Engineering Practices	10.5	(13.5)
K	Optional Courses		
	Theory	8.0	
	Sessional/Lab	3.0	
L	Project/Thesis	4.5	
Grand Total		160.0	

4.4 COURSES OFFERED IN DIFFERENT SEMESTERS FOR Bachelor of Sciencein CIVIL Engineering DEGREE:

1st Semester (8 courses)

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

2nd Semester (9 courses)

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

3rd Semester (9 courses)

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

4th Semester (9 courses)

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

5th Semester (8 courses)

CE 493	Professional Practices, Communication and Ethics	3.0	
CE 351	Structural Analysis and Design I	3.0	
CE 355	Design of Concrete Structures I	3.0	
CE 313	Waste water and Sanitation Engineering	4.0	
CE 321	Principles of Soil Mechanics	4.0	
CE 494	Professional Practice and Communication Sessional	1.5	
CE 314	Environmental Engineering Lab-I	1.5	
CE 324	Geotechnical Engineering Lab-I	1.5	
Total		**21.5**	

6th Semester (8 courses)

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

7th Semester (8 courses)

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

8th Semester (9 courses)

CE 490	Project/Thesis	3.0	
CE 452	Concrete Structures Design Lab II	1.5	
CE495	Socio-Economic Aspects of Development Projects	3.0	Select One
CE498	Business and Career Development	3.0	
CE 453	Introduction to Finite Element Method	2.0	Select Two (Structure)
CE 455	Prestressed Concrete	2.0	
CE 457	Design of Concrete Structures III	2.0	
CE 459	Dynamics of Structures	2.0	

CE 461	Introduction to Steel-Concrete Composite Structure	2.0	
CE 454	Computer Aided Analysis and Design Sessional	1.5	Structure
CE 411	Solid and Hazardous Waste Management	2.0	Select Two (Environment)
CE 413	Environmental Pollution Management	2.0	
CE 415	Environmental and Sustainable Management	2.0	
CE 414	Environmental Engineering Lab-II	1.5	Environment
CE 421	Earth Retaining Structures	2.0	Select Two (Geotechnical)
CE 425	Soil Water Interaction	2.0	
CE423	Elementary Soil Dynamics	2.0	
CE 427	Geotechnical Earthquake Engineering	2.0	
CE 424	Geotechnical Engineering Lab-II	1.5	Geotechnical
CE 431	Traffic Planning and Management	2.0	Select Two (Transportation)
CE 433	Pavement Management, Drainage and Airport	2.0	
CE 435	Urban Transportation Planning and Management	2.0	
CE 434	Transportation Engineering Lab-II	1.5	Transportation
CE 443	Ground Water Engineering	2.0	Select Two (Water Resource)
CE 445	River Engineering	2.0	
CE 447	Hydraulic Structures	2.0	
CE 449	Coastal Engineering	2.0	
CE 448	Water Resources Engineering Lab	1.5	Water Resource
Total		**18.5**	
Grand Total		**160.0**	

A. General Education

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

Introduction: current approaches to learning English, communication today.
Phonetics: phonetics and correct English pronunciation.
Syntax: vocabulary, diction and English sentence; sentence variety and style; grammatical problems.
Reading skill: readability, reading strategies, generating ideas through purposive reading, reading of selected stories, comprehension.
Writing skill: principles of effective writing; generating ideas, planning, organization and development of writing; composition, précis.
Written communication: business communication, tenders and quotations, journal articles, report.
Oral communication: dialogue, technical and scientific presentation.

Recommended Books:

New Headway Intermediate Student & Work Book, by Liz and John Soars.
Examples from Target English.

Recommended Books:

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

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

Reading skill: skimming, scanning, predicting, inferring; analysis and interpretation of texts; comprehension from literary and non-literary texts.
Writing skill: product approach, process approach: brain storming, self-evaluation, peer evaluation, revision/rewriting, teacher's evaluation; techniques of writing: comparison and contrast, problem and solution, cause and effect, classification, illustration; writing paragraph, essay and report.
Listening skill: listening to recorded texts; learning to take useful notes and answering questions.
Speaking skill: dialogue in peer work; participation in discussion and debate; extempore speech; narrating events; story telling; presentation.

Recommended Books:

As advised by the course teacher.

3. GED 153: Accounting (2.0 credit hours)

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

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

Recommended Books:

As advised by the course teacher.

4. GED 155: Sociology (2.00 credit hours)

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

Recommended Books:

As advised by the course teacher.

5. GED 157: Economics (2.00 credit hours)

Economics and engineering; microeconomics and macroeconomics; theory of demand and supply and their elasticity; demand estimation; price determination; indifference curve technique; theory of production; theory of cost and cost estimation; market structure; national income accounting, depreciation; circular flow of income and expenditure; cost-benefit analysis; payback period, NPV, IRR, inflation; economic feasibility of engineering undertakings.

Recommended Books:

As advised by the course teacher.

6. GED 159: Government (2.00 credit hours)

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

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

Regional and international organizations: SAARC, ASIAN, UNO.

Recommended Books:

As advised by the course teacher.

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

বাংলাভাষারপ্রয়োগ ও অপ-প্রয়োগ, বাংলাবানান ও ভাষাসম্পাদনা, বিরামচিহ্নেরপ্রয়োগ, পত্রলিখন, জীবন-বৃত্তান্ত তৈরিকরারকাঠামো, কারণ-দর্শানো নোটিশ, অভিযোগ-নামাএবংতারজবাব, সভারকার্য-বিবরণী (রেজুলেশন), নিয়োগবিজ্ঞপ্তি, চাকুরিরসাক্ষাৎকার-বিষয়কপত্র, নিয়োগপত্র ও যোগদানপত্র , চারিত্রিকসনদপত্র, অফিসআদেশ/ নোটিশবাবিজ্ঞপ্তি/ প্রেসবিজ্ঞপ্তি, স্যুভিনিরবাম্যাগাজিনেরজন্য বাণীএবংসম্পাদকীয়রচনা, ব্যবহারিকবাংলারচনা: একুশে ফেব্রুয়ারী, মুক্তিযুদ্ধ, বাংলাভাষা, বিশ্বায়ন, আকাশসংস্কৃতি।

Recommended Books:

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

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

Political Geography: Principalities (Janapads)
Attempts in History for Building Undivided state of Bengal and the Partition of Indian Sub-continent- (a) Shashanka (b) The Palas and the Senas (c) The Muslim Sultanate-IkhtiyarUddin Muhammad BakhtiyarKhalji, (d) The Mughals and Bengal-Revolt of the BharoBhuyeans (e) Bengal and the British- The Battle of the Plassey, and (g) The First War of Independence –the so-called Sepoy Mutiny.

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

Recommended Books:

1. Sirajul Islam (ed.) *Banglapedia: National Encyclopedia of Bangladesh,* (Dhaka: Asiatic Society of Bangladesh, 2003).
2. Sirajul Islam, (ed), *History of Bangladesh, 1704-1971*, Vol. I, II and III, (Dhaka: Asiatic Society of Bangladesh, 1992).
3. Willem van Schendel, *A History of Bangladesh* (Cambridge University Press, 2009).
4. SrinathRaghavan, 1971: *A Global History of the Creation of Bangladesh* (New Delhi: Permanent Black, 2013).
5. A. M Chowdhury and FakrulAlam (eds.), *Bangladesh on the Threshold of the Twenty First Century* (Dhaka: Asiatic Society of Bangladesh, 2002).
6. Salahuddin Ahmed and BazlulMobinChowdhury, *Bangladesh National Culture and Heritage: an introductory Reader*, (Dhaka: Independent University, Bangladesh, 2004).
7. Sheikh MujiburRahman, *The Unfinished Memoirs*, (Dhaka: The University Press Limited, 2012).
8. মুনতাসীরমামুন, ড. মো: মাহবুবররহমান, *স্বাধীনবাংলাদেশেরঅভ্যুদয়ের ইতিহাস*, ঢাকা, সুবর্ণ প্রকাশনী, ২০১২|
9. ড. মোঃমাহবুবুররহমান, *বাংলাদেশেরইতিহাস* ১৯৪৭-৭১, ঢাকা, সময়প্রকাশন, ১৯৯৯|
10. ড. আবদুররহিম, ড. আবদুলমমিন চৌধুরী, ড. এ. বি. এম. মাহমুদ, ড. সিরাজুলইসলাম, *বাংলাদেশেরইতিহাস*, ঢাকা, নওরোজকিতাকিস্তান, ১৯৭৭|

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

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

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

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

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

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

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

Populational- Structure and Growth of Bangladesh

Educational- primary, secondary and tertiary

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

Environmental-Environmental Challenges-Global Environmental Crisis and Bangladesh

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

Recommended Books:

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

B. Basic Sciences

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

Physical optics: theories of light; Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference at wedge shaped films, Newton's rings, interferometers; diffraction of light; Fresnel and Fraunhoffer diffraction, diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and n-slits-diffraction grating; polarization; production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction, retardation plates, nicol prism, optical activity, polarimeters, polaroid.

Waves and oscillations: differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Lissajous figures, spring-mass system, calculation of time period of torsional pendulum, damped oscillation, determination of damping co-efficient; forced oscillation, resonance, two-body oscillations, reduced mass, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.

Heat and thermodynamics: principle of temperature measurements: platinum resistance thermometer, thermo-electric thermometer, pyrometer; kinetic theory of gases: Maxwell's distribution of molecular speeds, mean free path, equipartition of energy, Brownian motion, Vander Waal's equation of state, review of the first law of thermodynamics and its application, reversible and irreversible processes, second law of thermodynamics, Carnot cycle; efficiency of heat engines, Carnots theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, third law of thermodynamics.

Recommended Books:

Zemansky, M. W. &Dutmann, R. H. (2007) *Heat and Thermodynamics*.Pearson Education India.
Halliday, D. &Resnic, 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). *Quamtum Mechanics*. Firewall Media.
Ahmad, D.G.(1995). *Physics for Engineering, Volume-I*.Bangladesh Academy of Sciences.
Richard, E. S., Claus, B. & Gordon, W. V. Van (6th ed., 1998), *Fundamentals of Classical Thermodynamics*, John Wiley & Sons.
Michael, J. M. and Howard N. S. (Latest edition), *Fundamentals of Engineering Thermodynamics*, John Wiley & Sons.
Gupta &Saxena P.N., *Fundamental of Solid State Physics*.

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

Structure of matter : crystalline and non-crystalline solids, single crystal and polycrystalline solids, unit cell, crystal systems, coordination number, crystal planes and directions, NaCl and CsCl structure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's law, methods of determination of interplanar spacing from diffraction patterns; defects in solids: point defects, line defects, bonds in solids, interatomic distances, calculation of cohesive and bonding energy; introduction to band theory: distinction between metal, semiconductor and insulator.

Electricity and Magnetism: Electric charge and Coulomb's law, Electric field, concept of electric flux and the Gauss's law- some applications of Gauss's law, Gauss's law in vector form, Electric potential, relation between electric field and electric potential, capacitance and dielectrics, gradient, Laplace's and Poisson's equations, Current, Current density, resistivity, the magnetic field, Ampere's law, Biot-Savart law and their applications, Laws of electromagnetic induction- Maxwell's equation.

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

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

Recommended Books:

Edward M. P. (Vol. II), *Electricity and Magnetism*.
Kenneth S. K, *Modern Physics*.
John, R. T, *Classical Mechanics*.
Halliday, D. &Resnick, R. (2010).*Physics, Volume-II*.John Wiley & Sons.
Gupta, S.L. , Kumar, V. & Singh, S.P. (1992). *Electrodynamics*.PragatiPrakashan.
Timoshenko, S. P. &Goodier, J. N. (2013).*Theory of Elasticity*.McGraw Hill, Cambridge University Press.
Haque, Roy &Rofiqullah.(2001). *Concepts of Electricity and Magnetism*.Cengage Learning.
Baiser.(1981).*Concept of Modern Physic*.McGraw-Hill International Book.
Subrahmanyam, N. &Brizlal.(2008). *Atomic and Nuclear Physics*, S. Chand Limited.
Theraja, B. L.(1988). *Modern Physics.* R.R. Bowker.
Saxena, R.S., Gupta, R.C. &Saxena, P.N.(1995). *Solid State Devices*, Inter University Board of India

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

Experiments based on theory learned in Engineering Physics I and Engineering Physics II:
Determination of line frequency by Lissajous figures using an oscilloscope and a function generator andverification of the calibration of time/div knob at a particular position for different frequencies; determination of frequency of a tuning fork by Melde's apparatus; determination of the spring constant andthe effective mass of a loaded spring; to draw magnetic induction versus current curve for a circular coilusingBiot-Savart law and hence to verify tangent law; determination of the moment of inertia of a flywheelabout its axis of rotation; determination of rigidity modulus of the material of a wire by static method; determination of the pressure-coefficient of air by constant volume air thermometer; determinationof the thermal conductivity of a bad conductor by lee's method; to plot the thermo-electromotive force vstemperature (calibration) curve for a given thermocouple (e5); determination of the melting point of a solidusing the calibration curve obtained in experiment-e5; determination of the mechanical equivalent of heatby electrical method; determination of the focal length of (i) a convex lens by displacement method and (ii)a concave lens by an auxiliary lens method; determination of the radius of curvature of a plano-convex lensby Newton's ring method; determination of specific rotation of sugar solution by a polarimeter; to verifyMalus' law of polarization; determination of the threshold frequency for the material of a photocathode andhence find the value of the Planck's constant; determination of lattice constant by x-ray.

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

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

chemical and ionic equilibria; chemistry of water; chemistry of water pollution; chemistry of cements, silicates and limes.

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

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

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

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

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

Recommended books:

Ebbing, D.D.,(1998).*General Chemistry*.A.I.T.B.S.
Haider, S.Z.,(1977). *Introduction To Modern Inorganic Chemistry*. Students' Publications.
Haider, S.Z.,(1975). *Advanced Inorganic Chemistry*.Students' Publications.
Haque, M.H. &Mollah, M.Y.A.,(2009). *Principles Of Physical Chemistry*. Brothers' Publication.
Bhal&Tuli,(2009). *Essential Of Physical Chemistry*. S. Chand Limited.

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

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

C. Mathematics

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

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

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

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

Recommended Books:

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

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

Ordinary differential equation: formation of differential equations; solution of first order differential equations by various methods; solution of differential equation of first order but higher degrees; solution of general linear equations of second and higher orders with constant co-efficient; solution of Euler's homogeneous linear differential equations.

Partial differential equation: introduction, linear and non-linear first order differential equations; standard forms; linear equations of higher order; equations of the second order with variable coefficients.

Statistics: measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions, e.g. normal and exponential distribution.

Recommended Books:

Ross, S. L. (1989). *Differential equations.*JhonWiley& Sons.
Rainville, E.D. &Zill,D.G. (2008). *A first course in differential equations with modeling applications by Elementary Differential Equations.*Cengage Learning.
Singhania, R. (2008). *Ordinary and Partial differential Equation.* S. Chand and Company Ltd.

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

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

Laplace Transforms: Definition; Laplace transforms of some elementary functions; sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives. The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms; Evaluation of improper integrals.

Recommended Books:

Spiegel, M.(1993). *Schaum's Outline series of Fourier Analysis.* McGraw-Hill.
Spiegel, M.(1965). *Schaum's Outline series of Laplace Transformation.*McGraw-Hill.

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

Co-ordinate Geometry: 2-Dimentional co-ordinate geometry: change of axes transformation of co-ordinates, simplification of equations of curves. 3-Dimentional co-ordinate geometry: system of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.
Vector analysis: scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence

and independence of vectors; definition of line, surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications

Recommended Books:

Rahman, A.F.M., &Bhattacharjee, P.K. (2005).*A Text Book of co-ordinate Geometry with Vector Analysis.* S. Chakroborty.
Rahman, A.(2001). *Linear Algebra*
Anton, H. &Rorres, C. (2010).*Elementary Linear Algebra.*John Wiley & Sons.
Lipschutz, S., & Lipson, M. (2008).*Schaum's Outline of Linear Algebra*. McGraw Hill Professional.

D. Engineering (Basic)

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

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

Recommended Books:

Faires Virgil Morning, Chambers Sherman (3rd Edition), *Analytic Mechanics*, The Macmillan Company, New York.
Beer Ferdinand P., Johnston E. Russel, *Vector Mechanics for Engineers (Static & dynamics)*, Tata McGraw – Hill Publishers.
Timoshenko & Young, *Engineering Mechanics*, McGraw – Hill Publishers.
Shames I.H., *Engineering Mechanics (Static & dynamics)*, Prentice Hall of India.

20. CE 103: Surveying (3.0 credit hours)

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

Recommended Books:

Shahjahan M., Aziz M.A., *A text Book of Surveying.*
Punmia B.C, Vol I (3rd Edition) *Surveying,* Laxmi Publication.
Punmia B.C, Vol III (9th Edition) *Surveying,* Laxmi Publication.
Basak N.N., *Surveying and Leveling*, Tata McGraw – Hill.

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

Properties and uses of aggregates, brick, cement; sand, lime, mortars; concrete; concrete mix design; wood structures and properties; shrinkage and seasoning; treatment and durability; mechanical properties; wood

products; advanced fiber reinforced polymer (FRP) composites and its application to civil engineering; reinforcement types, basic property of FRP composites and available FRP composite products; definition of stress and strain; plane stress and strain condition; identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials; time dependent strain response of these materials due to different types of loadings; mathematical and simple rheological modeling for prediction of creep behavior; ferrocement: advantages and uses; corrosion and prevention of steel in RC structures, offshore structures and ground applications.

Recommended Books:

Aziz M.A., (1995), *Engineering Materials*.
Singh Gurcharan& Singh Jagdish, (1996), *Building Materials,* Standard Publishers.
Krishnaraju N, *Technology of Concrete,* CBS Publishers & Distributors.
ASTM standard method of mix design

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

Minerals; identification of minerals, common rock forming minerals; physical properties of minerals; mineraloids rocks; types of rocks, cycle of rock change; earthquake and seismic map of Bangladesh.

Structural geology; faults; types of faults; fold and fold type; domes; basins; erosional process; quantitative analysis of erosional land forms.

Channel development; channel widening; valley shape; stream terraces; alluvial flood plains; deltas and alluvial fans; channel morphology; channel patterns and the river basin; geology and geomorphology of Bangladesh.

Recommended Books:

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

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

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

Recommended Books:

Popov Egor. P., *Engineering Mechanics of Solids,* Prentice-Hall of India.
Pytel Andrew, Singer Ferdinand L. (4th Edition), *Strength of Materials,* Harper & Row Publishers.
Beer Ferdinand P. & Johnston E. Russel, *Mechanics of Materials*, Tata McGraw-Hill Publishers.

Timoshenko S., *Strength of Materials (part I&II),* CBS Publishers & Distributors.
Gere James M., *Mechanics of Materials,* McGraw-Hill Publishers.
Nash William A., *Theory and Problems of Strength of Materials,* McGraw-Hill Book Company.

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

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

Recommended Books

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

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

Development and scope of fluid mechanics, fluid properties, fluid statics, kinematics of fluid flow, fluid flow concepts and basic equations, Bernoulli's equation, energy equation, momentum equation and forces in fluid flow. Similitude and dimensional analysis, steady incompressible flow in pressure conduits, laminar and turbulent flow, general equation for fluid friction, empirical equations for pipe flow, minor losses in pipe flow. Fluid measurement: Pilot tube, orifice, mouthpiece, nozzle, venturimeter weir. Pipe flow problems – pipes in series and parallel, branching pipes, pipe networks.

Recommended Books:

Daugherty L., Finnemore, Franjini, *Engineering Mechanics with Engineering Applications*, McGraw-Hill Book Company.
Khurmi R.S., *A Text Book of Hydraulics, Fluid Mechanics & Hydraulics Machines,* S. Chand & Company Ltd.
StreeterVictor, WylieBenjamin, (1st SI Edition), *Fluid Mechanics,* McGraw-Hill Book Company.
StreetRobert, Watters G. Z., Vennard J.K., (7th Edition), *Elementary Fluid Mechanics,* John Wiley & Sons.
Som and Biswas, *Introduction to Fluid Mechanics and Machines,* Tata McGraw-Hill Publisher.

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

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

Recommended Books:

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

Alexander Charles K., Sadiku Matthew N.O., (2004), *Fundamental of Electric circuits*, 2/e, Mc Grow Hill, New York.
Theraja B. L., A.K. (2004), *A text Book of Electrical Technology*, Vol.I: Basic Electrical Engineering, 34/e, S. Chand & Company Ltd., New Delhi.

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

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

Recommended Books:

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

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

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

Recommended Books:

As advised by the course teacher.

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

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

Recommended Books:

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

Balagurusamy E. *Object oriented programming with C++.*
Deitel*, Java how to program.*
SchildtHerbert*,* (3rd Edition)*, Tech yourself C.*

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

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

Recommended Books:

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

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

Introduction to computer usage; introduction to CAD packages and computer aided drafting: drawing editing and dimensioning of simple objects; plan, elevations and sections of multi-storied buildings; reinforcement details of beams, slabs, stairs etc; plan and section of septic tank; detailed drawings of roof trusses; plans, elevations and sections of culverts, bridges and other hydraulic structures; drawings of building services.

Recommended Books:

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

32. CE 108: Workshop Sessional (1.5 credit hours)

Carpentry Shop (3/2 hours per week)

Wood working tools; Wood working machine: Band saw, scroll saw, circular saw, jointer, thickness planer, disc sander, wood lathe; Types of sawing; Common cuts in wood works; Types of joint; Defects of timber; Commercial forms of timber. Characteristics of good timber; Use of fastening; Shop practice: Practical job, planning and estimating of a given job.
Machine Shop (3/4 hours per week)

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

Welding Shop (3/4 hours per week)

Methods of metal joints: Riveting, grooving soldering, welding; Types of welding joints and welding practice; Position of arc welding and polarity: Flat, vertical, horizontal, overhead; Electric arc welding and its machineries; Welding of different types of materials; Low carbon steel, cast iron, brass, copper,

stainless steel, aluminium; Types of electrode, fluxes and their composition; Arc welding defects; Test of arc welding: Visual, destructive and non-destructive tests.
Types of gas welding system and gas welding equipment; Gases and types of flames; welding of different types of materials; Gas welding defects; test of gas welding.

Recommended Books:

As advised by the course teacher.

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

Types of building, components of a building, design loads, framed structure and load bearing wall structure; foundations: shallow foundation and deep foundation, site exploration, bearing capacity of soil, standard penetration test; brick masonry: types of brick, bonds in brickwork, supervision of brickwork, brick laying tools, defects and strength on brick masonry, typical structures in brickwork, load bearing and non-load bearing walls, cavity walls, partition walls; lintels and arches: different types of lintels and arches, loading on lintels, construction of arches; stairs: different types of stairs, floors: ground floors and upper floors; roofs and roof coverings; shoring; underpinning; scaffolding and formwork; plastering, pointing, painting; distempering and white washing; cement concrete construction; sound insulation: acoustics; thermal insulation; house plumbing: water supply and wastewater drainage.

Recommended Books:

Kumar Sushil, *Building Construction,* Standard Publishers, Delhi.
Punmia B.C., *Building Construction,* Laxmi Publication Pvt. Ltd. New Delhi.
Beall Christine, *Complete Construction Masonry & Concrete,* McGraw-Hill Book Company.

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

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

Singh Gurcharan& Singh Jagdish, (1996), *Building Materials,* Standard Publishers.
Neville A.M. & Books J.J, *Concrete Technology,* Peeson Education Ltd.

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

Earthwork excavation for roadway, earthwork computation from spot levels; estimation for residential building: estimation of slab, beam, column, footing; analysis of rates, specifications, costing of residential building; estimation and costing of septic tank; estimation and costing of underground water reservoir; estimation and costing of retaining wall; estimation and costing of slab culvert; estimation and costing of bridges; highways construction; estimation of steel truss; computer aided quantity estimation; construction site survey and estimation.

Recommended Books:

Khan AbulFaraz, *Estimating,* Sabdik Publishers.

Pasrija, Arora, Inderjit Singh, *Estimating, Costing & Valuation (Civil),* New Asian Publishers, Delhi.
Kohli D., Kohli R.C., *A Text Book on Estimating & Costing (Civil) With Drawings*, Ambala Ramesh Publication.
BNBC & PWD rate-charts are helpful.

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

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

Recommended Books:

As advised by the course teacher.

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

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

Recommended Books:

As advised by the course teacher.

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

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

Introduction to high-level computational programming tools; application to numerical analysis: basic matrix computation, solving systems of linear equations, non-linear equations, differential equations, interpolation and curve fitting, numerical differentiation, numerical integration; application to engineering problems: solving problems related to mechanics, numerical solution of equation of motion etc.

Recommended Books:

As advised by the course teacher.

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

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

Recommended Books:

As advised by the course teacher.

E. Structural Engineering

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

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

Recommended Books:

As advised by the course teacher.

Recommended Books:

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

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

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

Recommended Books:

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

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

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

Recommended Books:

Weaver William, Gere James, (2nd Edition), *Matrix Analysis of Framed Structures*, CBS Publishers & Distributors.
Norris Charles, Wilbur J. &UtkuSenol, (4th Edition), *Elementary Structural Analysis*, McGraw-Hill Int'l Edition.
Kinney J. S., *Indeterminate Structural Analysis,* Oxford & IBH Publishing Company Ltd.
Wang C. K., *Statically Indeterminate Structures,* McGraw-Hill Book Company.

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

Fundamental behavior of reinforced concrete; introduction to strength design and alternate design methods; flexural design of beams (singly reinforced, doubly reinforced, T-beam) using strength design method; shear, diagonal tension and torsion of beams; bond and anchorage; design of one way slabs; design of two-way edge supported slabs: using strip and alternate methods.

Recommended Books:

Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.
Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education).
Nilson, Drawing, Dolan Charles, Wang Chukia& Salmon Charles G. (6th Edition), *Reinforced Concrete Design,* John Wiley & Sons.
Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education.
Ferguson, Breen, Jirsa, *Reinforced Concrete Fundamentals,* John Wiley & Sons Inc.
Limbrunner George F. &SpigelLeonard,*Reinforced Concrete Design,* Prentice – Hall of India Pvt. Ltd.

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

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

Recommended Books:

Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.
Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education).
Nilson, Drawing, Dolan Charles, Wang Chukia& Salmon Charles G. (6th Edition), *Reinforced Concrete Design,* John Wiley & Sons.
Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education.
Ferguson, Breen, Jirsa, *Reinforced Concrete Fundamentals,* John Wiley & Sons Inc.
Limbrunner George F. &SpigelLeonard,*Reinforced Concrete Design,* Prentice – Hall of India Pvt. Ltd.

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

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

Recommended Books:

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

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

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

Recommended Books:

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

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

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

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

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

Recommended Books:

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

F. Environmental Engineering

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

Water supply engineering: introduction; water demands, water supply sources, ground water exploration; aquifer properties and ground water flow, well hydraulics, water well design, drilling, construction and maintenance; water demand for rural communities; shallow hand tubewells and deep set Tara pumps for problem areas. State of centralized water management system in the country, Urbanization vs. recharge factors in the new towns and cities of the country, Rainwater harvesting.

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

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

Recommended Books:

Aziz M. A. (1st Edition), *Water Supply Engineering,* Hafiz Book Center, Dhaka.
Mara Duncan (1976), *Sewage Treatment in Hot Climates,* John Wiley & Sons, London.
McGheeTerence, Steel E. W. (November 1990), *Water Supply & Sewerage*, McGraw-Hill Int'I Edition.
Hammer Mark J. (4th Edition), *Water & Waste Water Treatment,* Prentice-Hall of India Pvt. Ltd.

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

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

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

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

Recommended Books:

Ahmed M. Feroze, Rahman Md. Mujibur, (2nd Edition, 1974), *Water Supply & Sanitation*, ITN Bangladesh.
PeavyHoward, Rowe, Tchobanoglous (1985), *Environmental Engineering,* McGraw-Hill Book Company.
Mara Duncan (1976), *Sewage Treatment in Hot Climates,* John Wiley & Sons, London.
McGheeTerence, Steel E. W. (November 1990), *Water Supply & Sewerage*, McGraw-Hill Int'I Edition.
Hammer Mark J. (4th Edition), *Water & Waste Water Treatment,* Prentice-Hall of India Pvt. Ltd.
Metcalf & Eddy, (3rd Edition), *Waste Water Engineering: Treatment, Disposal, Reuse*, McGraw-Hill Inc.
Hornung William J., *Plumbing & Heating,* Prentice-Hall, Inc. Newjersy.
Babbitt Harold E., *Plumbing,* McGraw-Hill Book Company.

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

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

Recommended Books:

USEPA (U. S. Environment Protection Agency) Standard Test Method.
WHO (World Health Organization) Standard Test Method.
Hammer Mark J. (4th Edition), *Water & Waste Water Treatment,* Prentice-Hall of India Pvt. Ltd.

G. Geotechnical Engineering

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

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

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.
Das B. M. (6th Edition), *Principles of Geotechnical Engineering,* Thomson Brooks/Cole.
Codute Donald P., *Geotechnical Engineering-Principles & Practice*, Prentice-Hall of India.
Punmia B. C. (13th Edition), *Soil Mechanics & Foundation,* Laxmi Publication, New Delhi.

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

Soil investigation techniques: settlement computation; types of foundations; bearing capacity of shallow and deep foundations; settlement and distortion of foundations; design and construction of footings, rafts and piles; slope stability analysis.

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.
Bowles Joseph E., *Foundation Analysis & Design,* McGraw-Hill Book Company.
Codute Donald P., *Geotechnical Engineering-Principles & Practice*, Prentice-Hall of India.
Punmia B. C. (13th Edition), *Soil Mechanics & Foundation,* Laxmi Publication, New Delhi.
Scott C. R., (3rd Edition), *An Introduction to Soil Mechanics & Foundation,* Applied Science Publishers, London.
Tomlinson M. J., *Foundation Design & Construction,* Addison Wesley Longman Ltd.
Teng W. C., *Foundation Design & Construction,* McGraw-Hill Book Company.

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

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

Recommended Books:

Lambe T. William, (1951), *Soil Testing for Engineers,* MIT.
Day Robert W., (2001), *Soil Testing Manual: Procedure, Classification Data & Sampling Practices,* McGraw-Hill Book Company.
Hanna T. H. (1985), *Field Instrument in Geotechnical Engineering*, Trans Tech Publication, USA.
ASTM or AASHTO Standard Test Method.

H. Transportation Engineering

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

Transportation engineering, transportation functions; transportation systems, functional components, factors in transportation development, transportation modes, public transportation, emerging modes; intelligent transportation system: components and applications; transport planning: concepts, scope and hierarchy, process, goals and objectives, inventories, socio-economic activities, land use- transport interaction, travel demand forecasting; road safety and accident analysis.

Geometric design of highways: design controls and criteria, cross sectional elements, alignment, sight distance, intersection and interchange layouts, planning and design of bicycle and pedestrian facilities; traffic engineering: fundamentals of traffic engineering, vehicle and traffic characteristics, traffic control devices and systems, traffic studies, planning and design of parking facilities, roadway lighting; transportation in Bangladesh: transportation modes and networks, constraints and challenges, transport demand and modal share, road classification and design standards.

Recommended Books:

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

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

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

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

Recommended Books:

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

KhistryJotin*,* Lal Kent, (3rd Edition), *Transportation Engineering: An Introduction,* Prentice Hall Publication.
Planning Commission, Government of Bangladesh, *Transport Sector Status Report-Transport Sector Coordination Wing.*
Ministry of Communications, Government of Bangladesh*, RHD Road Network Database: Annual Report-Roads & Highways Department*.
Bangladesh Gadget*, Road Design Standards*, September 5, 2004
Geometric Design Standards of RHD.
Information Book of Bangladesh Railway, 2004.
Hay William W*Introduction to Transportation Engineering,* John Wiley, New York.

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

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

Recommended Books:

As advised by the course teacher.

I. Water Resources Engineering

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

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

Recommended Books:

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

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

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

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

Recommended Books:

GargSantosh K., (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures,* Khanna Publishers.
HansenV.,Israelsen W., Stringham,*Irrigation Principles & Practices,* John Wiley & Sons, Inc.
MajumderD.K.,*Irrigation Water Management Principles & Practice,* Prentice-Hall of India Pvt. Ltd.

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

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

Recommended Books:

As advised by the course teacher.

J. Civil Engineering Practice

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

Project planning and evaluation; feasibility reports; cash flows, payback period, internal rate of return; benefit-cost ratio; cost-benefit analysis case studies;Planning and scheduling, PERT, CPM; resource scheduling; linear programming and application.
Principles of management; construction management: principles, project organization, methods and practices, technology, management of materials and equipments, site management, contracts and specifications, inspection and quality control, safety, economy. Conflict management; psychology in administration: human factors
in management; human resource management. Demand forecasting; inventory control; stores management; procurement; legal issues in construction; environmental regulations.

Recommended Books:

Kerzner Harold, (7th Edition), *Project Management: A System Approach to Planning, Scheduling & Controlling,* John Wiley & Sons.
Riggs James L., (3rd Edition), *Production Systems: Planning Analysis & Control* John Wiley & Sons, New York.
CloughRichard H., SearsG.A.,*Construction Project Management*(4th Edition) (August 2000), John Wiley & Sons.

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

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

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

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

Recommended Books:

Corporate Communication: Theory and Practice by Michael B. Goodman.
Corporate Communication: Strategic Adaptation for Global Practice by Michael B. Goodman, Peter B. Hirsch.
Corporate communication by Paul A. Argenti.

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

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

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

Recommended Books:

As advised by the course teacher.

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

Economics and social structure; development and economic growth; socio-economic indicators; concept of human development, human development index; gender related human development index; human poverty and human poverty index; poverty reduction strategies in Bangladesh; concepts of sustainable

development; MDGs. Characteristics of development projects; human interest related aspects; population displacement; resettlement and rehabilitation strategy; Productivity; land loss, land use and land ownership patterns; fisheries and aquaculture; deforestation and afforestation; communication, commerce, industries and other economic benefits;water supply, sanitation, health and nutrition; inequalities in distribution of benefits and losses; Socio-economic impact assessment approach; socio-economic survey; case studies.

Recommended Books:

Understanding Socio-economic and Political Factors to Impact Policy Change. Report No. 36442 – GLB. The World Bank, Social Development Department, November 2006.
Independent evaluation at the Asian development bank by Oliver Serrat.
Stone, S., A. Strutt, and T. Herte.2010.Assessing Socioeconomic Impacts of Transport Infrastructure Projects in the Greater Mekong Sub region.ADBI Working Paper 234. Tokyo: Asian Development Bank Institute. Available: http://www.adbi.org/working-paper/2010/08/03/3976.socioeconomic.transport.infrastructure.mekong/

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

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

Recommended Books:

As advised by the course teacher.

K. Optional Courses

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

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

Recommended Books:

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

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

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

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

Recommended Books:

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

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

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

Recommended Books:

LinT.Y., BurnsNed H, (3rd Edition), *Prestressed Concrete*, John Wiley & Sons, Inc.
Winter George, Rourke O', Nilson, (7th Edition), *Design of Concrete Structures*, Tata McGraw-Hill Publisher, New Delhi.
Design of Concrete Structure (13th Edition)- (McGraw-Hill Higher Education)
Nilson, Drawing, Dolan Charles, Wang Chukia& Salmon Charles G. (6th Edition), *Reinforced Concrete Design,* John Wiley & Sons.
Williams Alan, *Civil & Structural Engineering Design of Reinforced Concrete Structure*, Kaplan AEC Education
Limbrunner George F. &SpigelLeonard,*Reinforced Concrete Design,* Prentice – Hall of India Pvt. Ltd.

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

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

Recommended Books:

Dynamics of Structures (4th Edition) By Anil K. Chopra
Fundamentals of Structural Dynamics ByRoy R. Craig, Andrew J. Kurdila
Structural Dynamics: Theory and Computation ByMario Paz
Dynamics of Structures by Clough and Tenzial,

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

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

Recommended Books:

Steel-Concrete Composite Structures by R Narayanan
Composite Structures of Steel and Concrete: Beams, Slabs, Columns, and Frames for Buildings, 3rd Edition by R. P, Johnson
Design of Composite Steel-Concrete Structures by Lloyd. C. P. Yam
Structural Steel: Steel-concrete composite structures by N. E. Shanmugan and Y. S. Choo

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

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

Recommended Books:

As advised by the course teacher.

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

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

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

Recommended Books:

Peavy, Rowe, Tchobanoglous, *Environmental Engineering,* McGraw-Hill Inc.
Lagrega, Buckingham, J. Evans, (2nd Edition), *Hazardous Waste Management,* McGraw-Hill Book Company.

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

Environmental pollution and its Control; water pollution: sources and types of pollutants; waste assimilation capacity of streams; dissolved oxygen modeling; ecological balance of streams; industrial pollution; heavy metal contamination; detergent pollution and eutrophication; groundwater pollution; marine pollution; pollution control measures: water quality monitoring and management.

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

Recommended Books:

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

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

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

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

Recommended Books:

Environmental Impact Assessment For Developing Countries In Asia-ADB, 1997
Canter Larry W., *Environmental Impact Assessment,* McGraw-Hill Book Company.

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

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

Recommended Books:

As advised by the course teacher.

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

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

Recommended Books:

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

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

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

Recommended Books:

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

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

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

Recommended Books:

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

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

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

Recommended Books:

Peck Ralph B., Hanson, Thornburn, (2nd Edition, 1974), *Foundation Engineering*, Wiley Eastern Limited, India.
Bowles Joseph E., *Foundation Analysis & Design,* McGraw-Hill Book Company.
Lambe T. William, (1951), *Soil Testing for Engineers,* MIT.
Day Robert W., (2001), *Soil Testing Manual: Procedure, Classification Data & Sampling Practices,* McGraw-Hill Book Company.
Hanna T. H. (1985), *Field Instrument in Geotechnical Engineering*, Trans Tech Publication, USA.
ASTM or AASHTO Standard Test Method.

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

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

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

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

Recommended Books:

Wright Paul H., DixonKaren, (7th Edition), *Highway Engineering,* John Wiley & Sons, Inc.
Kadiyali L.R., (2nd Edition), *Traffic Engineering & Transportation Planning,* Khanna Publishers.
O'Flaherty C.A., *Highway-Traffic Planning & Engineering,* Edward Arnold, UK.
The Institute of Transportation Engineers, Transportation & Traffic Engineering Hand Book, Prentice-Hall (1982)

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

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

Recommended Books:

Wright Paul H., DixonKaren, (7th Edition), *Highway Engineering,* John Wiley & Sons, Inc.
HoronjeffRobert, McKelvey, (4th Edition, 1994), *Planning & Design of Airports* McGraw-Hill Book Company.
Federal Aviation Administration (FAA) Guidelines.

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

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

Recommended Books:

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

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

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

Recommended Books:

As advised by the course teacher.

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

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

Recommended Books:

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

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

Behavior of alluvial rivers; river channel pattern and fluvial processes; aggradation and degradation, local scours, river training and bank protection works; navigation and dredging sediment movement in river channels, bed form and flow regimes.

Recommended Books:

GargSantosh K. (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures,* Khanna Publishers.
Petersen, M.S. (1986). *River Engineering*. Prentice-Hall
Graf, W.H.,*Hydraulics of Sediment Transport*, McGraw-Hill.
Grade R.J., RangaRajuK.G., (2nd Edition), *Mechanics of Sediment Transportation & Alluvial Stream Problems.*Wiley Eastern Ltd.

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

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

Recommended Books:

GargSantosh K. (17th Edition, 2003), *Irrigation Engineering & Hydraulic Structures,* Khanna Publishers.
Sharma R.K., *Text Book of Irrigation Engineering & Hydraulics Structures*, Oxford and IBH Publishing, New Delhi.
Different Design Manual/Handbook/Annual Reports of Bangladesh Water Development Board.

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

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

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.

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

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

Recommended Books:

As advised by the course teacher.

Chapter 5

Course Curriculum Mapping for Undergraduate Studies

5.1 Vision and Mission of UITS:

Vision of UITS:

University of Information Technology and Sciences aims at redefining goals of higher education and sustainable economic growth of the country through a tripartite relationship among itself, industries and reputed universities, institutions at home and abroad. The University imparts experiential learning which enables students, teachers and community partners to integrate academic learning with practice while addressing specific community needs. The learning process empowers students to take initiative and to engage in an integrated and multidimensional ways to address the diverse cultural needs of Bangladesh and the global village. In UITS, we believe that teachers are facilitator of learning rather than a presenter of information. In order to challenge the needs of learning, UITS has the congenial atmosphere for disseminating the knowledge by providing logistic support and infrastructure. The University strives to attract and nurture scholars from the national and international universities through excellence in teaching and learning, research and knowledge exchange, scaffolding future scholars by fostering creativity, tolerance and responsibility.

Mission of UITS:

The University of Information Technology and Sciences will endeavor

- To provide a comprehensive education by developing fully the intellectual and personal strengths of its students while allowing knowledge to be more accessible to the larger community.
- To explore higher education in an experiential learning environment, Critical thinking, creativity, innovation, scholarly endeavors, and the enhancement of comprehensive knowledge.
- To impart a flexible and supportive intellectual environment that retains and nurture scholars, students and staff of the highest caliber in a culture that enhances learning and freedom of thought, enquiry and expression.
- To generate and disseminate knowledge to strengthen our society and the environment.
- To support student affiance and student development with local and international organization for Project and Research collaboration through the research center.
- To create new future values by taking on challenging and innovative research.

5.2 Vision and Mission of Department of Civil Engineering:

Vision:

The Vision of the Department of Civil Engineering is to achieving excellence in quality higher education, research, innovation, and societal services. Our students are the agents who make an impact in the society as professionals, academics, and innovators for sustainable development.

Mission:

The Department of Civil Engineering seeks to equip and produce highly qualified and committed academic leaders, professional practitioners, and administrators to deal adequately with Engineering and Technological challenges towards achieving societal upliftment and sustainable development.

5.3 Program Objectives, Outcomes and Mapping:

Program Educational Objectives (PEOs)

PEO1: Apply civil engineering knowledge to develop systems, and provide services that meet societal needs and achieve sustainable development.

PEO2: Increase personal knowledge and technical skills through professional and graduate study, certifications, and work responsibilities and challenges in order to be the preferred choice of employers.

PEO3: Contribute time, knowledge and skills to the profession, family, community, and the world beyond job responsibilities.

Program Outcomes (POs)

PO No	Program Outcome (PO) of Civil Engineering Student, UITS	PO of BAETE
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	[BAETE **a**]
PO2	**Problem analysis:** Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.	[BAETE **b**]
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.	[BAETE **c**]
PO4	**Investigation:** Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.	[BAETE **d**]
PO5	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.	[BAETE **e**]
PO6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	[BAETE **f**]
PO7	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.	[BAETE **g**]
PO8	**Ethics:** Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.	[BAETE **h**]

PO9	**Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.	[BAETE **i**]
PO10	**Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.	[BAETE **j**]
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.	[BAETE **k**]
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.	[BAETE **l**]

Mapping PLOs against PEOs

Program Outcomes (POs)	Program Educational Objectives (PEOs)		
	PEO1	PEO2	PEO3
PO1	√		√
PO2		√	
PO3	√		
PO4		√	
PO5		√	
PO6	√		√
PO7	√		
PO8		√	√
PO9		√	
PO10		√	
PO11		√	
PO12			√
Total	**4**	**7**	**4**

Mapping PEOs against Vision and Mission of the Department

Program Educational Objectives (PEOs)	Vision of the Department	Mission of the Department
PEO1	√	√
PEO2	√	
PEO3		√
Total	**2**	**2**

Mapping PEOs against Vision and Mission of the University

Program Educational Objectives (PEOs)	Vision of the University	Mission of the University
PEO1		√
PEO2	√	√
PEO3	√	
Total	**2**	**2**

SL No.	Course Code	Course Title	Credits	Program Learning Outcomes (POs)											
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
General Education (9.5 Credits)															
1	GED 101	The Four Skills of Communication in English I	2.0									√	√		
2	GED 102	Developing English Language skills lab	1.5									√	√		
3	GED 153	Accounting	2.0											√	
4	GED119	History of the Emergence of Independent Bangladesh (optional)	2.0								√				√
5	GED117	Bengali Language and Literature (optional)	2.0										√		
6	GED105	Bangladesh Studies (optional)	2.0			√									
7	GED 155	Sociology (optional)	2.0			√			√		√				
8	GED 157	Economics (optional)	2.0						√						
9	GED 159	Government (optional)	2.0						√						
Basic Science (12 Credits)															
10	PHY 175	Physical Optics, Waves and Oscillation, Heat and Thermodynamics	3.0	√			√								
11	PHY 177	Structure of Matter, Electricity and Magnetism and Modern Physics	3.0	√			√								
12	PHY 176	Engineering Physics Lab	1.5	√			√								√
13	CHE175	Engineering Chemistry	3.0	√			√								
14	CHE 176	Engineering Chemistry Lab	1.5	√			√								√

Mathematics (12 Credits)															
15	MAT153	Differential and Integral Calculus, Matrices	3.0	√			√								
16	MAT 155	Differential Equations and Statistics	3.0	√			√								
17	MAT 257	Coordinate Geometry and Vector Analysis	3.0	√			√								
18	MAT 259	Fourier Analysis and Laplace Transformation	3.0	√			√								
Basic Engineering (44 Credits)															
19	CE 101	Engineering Mechanics	3.0	√	√										
20	CE 103	Surveying	3.0	√	√		√								
21	CE 201	Engineering Materials	3.0	√	√	√	√								
22	CE 203	Engineering Geology and Geomorphology	3.0	√					√						
23	CE251	Mechanics of Solids I	3.0	√	√										
24	CE253	Mechanics of Solids II	3.0	√	√										
25	CE 241	Fluid Mechanics	3.0	√	√										
26	EEE 241	Fundamentals of Electrical Engineering	3.0	√											
27	CE 209	Numerical Methods and Analysis	2.0	√	√		√								
28	CE106	Practical Surveying	1.5				√	√							√
29	CSE 252	Computer Programming Lab	1.5		√		√	√							
30	CE 102	Civil Engineering Drawing	1.5	√			√								
31	CE 104	Computer Aided Drafting	1.5	√			√	√							
32	CE 108	Workshop Sessional	1.5				√	√							
33	CE 202	Details of Construction Lab	1.5	√					√			√			√
34	CE 204	Engineering Materials Lab	1.5				√	√							
35	CE 206	Quantity Surveying	1.5				√	√							

36	CE 208	Structural Mechanics Lab	1.5				√	√							
37	CE 242	Fluid Mechanics Lab	1.5				√	√							
38	CE 304	Engineering Computation Lab	1.5				√	√							
39	CE 302	Remote Sensing and GIS Lab	1.5				√	√							
Structural Engineering (22.5 Credits)															
40	CE 351	Structural Analysis and Design I	3.0	√		√	√								
41	CE 353	Structural Analysis and Design II	3.0	√		√	√								
42	CE 451	Structural Analysis and Design III	3.0	√		√	√								
43	CE 355	Design of Concrete Structures I	3.0	√		√	√								
44	CE 357	Design of Concrete Structures II	3.0	√		√	√								
45	CE 359	Design of Steel Structures	3.0	√		√	√								
46	CE 360	Steel Structures Design Lab	1.5	√		√		√							
47	CE356	Concrete Structures Design Lab I	1.5	√		√		√							
48	CE 452	Concrete Structures Design Lab II	1.5	√		√		√							√
Environmental Engineering (8.5 Credits)															
49	CE 311	Water Supply Engineering	3.0	√		√									
50	CE 313	Waste water and Sanitation Engineering	4.0	√		√									
51	CE 314	Environmental Engineering Lab-I	1.5				√	√							
Geotechnical Engineering (8.5 Credits)															
52	CE 321	Principles of Soil Mechanics	4.0	√		√									
53	CE 323	Foundation Engineering	3.0	√	√	√									
54	CE 324	Geotechnical Engineering Lab-I	1.5				√	√							
Transportation Engineering (8.5 Credits)															

55	CE 331	Transportation Planning and Traffic Engineering	3.0	√		√									
56	CE 333	Pavement Design and Railway Engineering	4.0	√	√	√									
57	CE 334	Transportation Engineering Lab-I	1.5				√	√							
Water Resources Engineering (8.5 Credits)															
58	CE 341	Open Channel Flow	4.0	√	√	√									
59	CE 345	Hydrology, Irrigation Engineering and Flood Management	3.0	√	√										
60	CE 342	Open Channel Flow Lab	1.5				√	√							
Civil Engineering Practices (10.5 Credits)															
61	CE 491	Project Planning and Construction Management	3.0			√			√		√	√		√	√
62	CE 493	Professional Practices, Communication and Ethics	3.0								√	√	√		√
63	CE 494	Professional Practices and Communication Sessional	1.5								√	√	√		√
64	CE495	Socio-Economic Aspects of Development Projects (Optional)	3.0			√		√	√						
65	CE498	Business and Career Development (Optional)	3.0						√		√	√	√	√	√
Major + Minor Optional Courses (11 Credits)															
Structural Engineering															
66	CE 453	Introduction to Finite Element Method	2.0	√		√									
67	CE 455	Prestressed Concrete	2.0	√	√	√									
68	CE 457	Design of Concrete Structures III	2.0	√	√	√									
69	CE 459	Dynamics of Structures	2.0	√	√	√									

70	CE 461	Introduction to Steel-Concrete Composite Structures	2.0	√	√	√									
71	CE 454	Computer Aided Analysis and Design Sessional	1.5		√			√							√
Environmental Engineering															
72	CE 411	Solid and Hazardous Waste Management	2.0	√	√	√			√						
73	CE 413	Environmental Pollution Management	2.0	√	√				√						
74	CE 415	Environmental and Sustainable Management	2.0			√			√	√					
75	CE 414	Environmental Engineering Lab-II	1.5		√			√							
Geotechnical Engineering															
76	CE 421	Earth Retaining Structures	2.0	√	√	√									
77	CE 425	Soil Water Interaction	2.0	√	√	√									
78	CE423	Elementary Soil Dynamics	2.0	√	√	√									
79	CE 427	Geotechnical Earthquake Engineering	2.0	√	√	√			√						
80	CE 424	Geotechnical Engineering Lab-II	1.5		√			√							√
Transportation Engineering															
81	CE 431	Traffic Planning and Management	2.0	√	√	√				√					
82	CE 433	Pavement Management, Drainage and Airport	2.0	√	√	√									
83	CE 435	Urban Transportation Planning and Management	2.0	√	√	√			√						
84	CE 434	Transportation Engineering Lab-II	1.5		√			√							√
Water Resources Engineering															
85	CE 443	Ground Water Engineering	2.0	√	√	√									
86	CE 445	River Engineering	2.0	√	√	√									

87	CE 447	Hydraulic Structures	2.0	√	√	√									
88	CE 449	Coastal Engineering	2.0	√	√	√									
89	CE 448	Water Resources Engineering Lab	1.5		√			√							√
TOTAL															

	PEO 1	PEO 2	PEO 3
PO1	X		
PO2	X	X	
PO3	X		
PO4	X		
PO5	X	X	
PO6		X	X
PO7		X	X
PO8		X	X
PO9		X	X
PO10	X	X	
PO11	X	X	
PO12		X	

PO No.	Program Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.
PO4	**Investigation:** Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PO5	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.
PO6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PO9	**Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

Figure: P0-PEO Mapping.

General Education

Course Title	The Four Skills of Communication in English I	**Course Code**	GED 101	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course is designed to improve English language skills in Listening, Reading, Writing and Speaking. It also consolidates and extends essential language covered in student's activities like Vocabulary, Grammar & Pronunciation to develop writing skills and confidence in typical problem areas in English.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Achieve a marked improvement in their: spoken English, reading and listening comprehension, vocabulary, conversation, pronunciation and grammar. (PO9, PO10)

CO 2: Converse freely and make short oral presentations in English. (PO10)

CO 3: Comprehend, summarize and discuss the main points of authentic texts about general or academic Reading (PO9, PO10)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Achieve a marked improvement in their: spoken English, reading and listening comprehension, vocabulary, conversation, pronunciation and grammar.	Speed reading (highlighting, getting information from text quickly finding your way around texts noting key words, following main arguments, interacting with the text and summarization. Extensive reading (reading outside class books selected by teachers; at least two books will be read).	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Converse freely and make short oral presentations in English.	Public speaking. Speaking on favorite food.	Lecture, Hand/Multimedia Demonstration	Class Test, Final Exam
Comprehend, summarize and discuss the main points of authentic texts about general or academic Reading	Paraphrasing & Summarizing, Organizing a paragraph: topic sentence, detailed sentences, logical order and conclusions. Phonetics chart	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam

Course Title	Developing English Language skills lab	Course Code	GED 102	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	GED 101
Synopsis	This course effectively prepares students for the IELTS examination. It includes the teaching of test practice strategies skills for all areas of the IELTS exam. It is comprehensive and academically rigorous. The IELTS course puts equal weight on reading writing, listening, speaking and test taking strategies. The course also covers sub skills such as academic vocabulary, academic style and study skills each day.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Recognize the different types of questions asked in IELTS Tests and Use a variety of sentence patterns with grammatical accuracy **(PO9, PO10)**

CO 2: Identify implications and propose solutions edit written work **(PO9, PO10)**

CO 3: Transfer information gathered from listening to written answers within the set time limit **(PO9, PO10)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Recognize the different types of questions asked in IELTS Tests and Use a variety of sentence patterns with grammatical accuracy	Critical readings (make judgments about how a text is argued, reflecting and making personal response as well as COse scrutiny of language to understand writer's attitude and perspectives). Using the patterns and the rules of English grammar to produce grammatically complete and correct sentences independently. IELTS Reading, Writing, listening & Speaking practice.	Lecture, Hand/Multimedia Demonstration	Assignment, Class Test, Final Exam
Identify implications and propose solutions edit written work	Writing different types of essays: narrative, descriptive, exPOratory etc. Writing paragraphs following different modes of writing: definition, description, classification, cause and effect, comparison and contrast, argumentative. Writing paragraphs following different modes of writing: definition, description, classification, cause and effect, comparison and contrast, argumentative.	Lecture, Hand/Multimedia Demonstration	Assignment, Class Test, Final Exam
Transfer information gathered from listening to written answers within the set time limit	Listening and demonstrating comprehension of a variety of sources at defined competency level (Elementary to pre-intermediate level). Listening and responding to texts (i,e, following instructions, answering questions, reacting to texts etc.)	Lecture, Hand/Multimedia Demonstration	Assignment, Class Test, Final Exam

Course Title	Accounting	Course Code	GED 153	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Governance, Bureaucracy, Issues of Accountability, Development Partners and the Agenda for Good Governance, Globalization, Economic Reform and supply and Demand Side of Good Governance, The Role of Politics in Governance.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge of accounting records and how to record transactions in them. (PO6)
CO 2: Prepare a set of financial statements for various forms of businesses and non-profit entities. (PO6)
CO 3: Apply accounting concepts, principles and practices. (PO6)
CO 4: Be familiar with the basic tools for analyses of financial statements. (PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge of accounting records and how to record transactions in them.	Financial accounting: objectives and importance of accounting, accounting as an information system; basic accounting principles; accounting equation; recording system.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Prepare a set of financial statements for various forms of businesses and non-profit entities.	Accounting cycle, journal, and ledger, and trial balance, preparation of financial statements considering adjusting entries, financial statement analysis and interpretation.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply accounting concepts, principles and practices.	Cost accounting: cost concepts and classification; cost-volume-profit analysis; contribution margin approach and its application, break-even analysis, target profit analysis, operating leverage.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Become familiar with the basic tools for analyses of financial statements.	Absorption costing versus variable costing, job order costing, capital budgeting, long run planning and control.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title		Course Code	GED 119	Credit Hour	2.0

	History of Emergence of Bangladesh	**Contact Hours/week**	2.0	**Prerequisite**	N/A
Synopsis	This course has been designed to acquaint the students with the history of Bangladesh in order to instill in them the spirits of nationalism so as to enable them to become proud citizens of Bangladesh.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Discuss the glorious past of Bangladesh and the creations of ancestors.**(PO8)**
CO 2: Designate the deferent phases of the historical development and the diversity of Cultural trait.**(PO8, PO12)**
CO 3: Estimate the heroic movements of the people of Bangladesh.**(PO12)**
CO 4: Appraise the contribution of Bangabandhu Sheikh Mujibur Rahman **(PO8, PO12)**
CO 5: Evaluate the emergence of Bangladesh as an independent country. **(PO12)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Discuss the glorious past of Bangladesh and the creations of ancestors.	Political Geography: Principalities (Janapads)	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Designate the deferent phases of the historical development and the diversity of Cultural trait.	Attempts in History for Building Undivided state of Bengal and the Partition of Indian Sub-continent-(a) Shashanka (b) The Palas and the Senas. (c) The Muslim Sultanate-Ikhtiyar Uddin Muhammad Bakhtiyar Khalji, s (d) The Mughals and Bengal-Revolt of the BharoBhuyean (e) Bengal and the British- The Battle of the Plassey, and (g) The First War of Independence – the so-called Sepoy Mutiny.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Estimate the heroic movements of the people of Bangladesh.	The Partition of Bengal in 1905 and its Annulment in 1911. Creation of Pakistan and status of Bengal within Pakistan. The Language Movement.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Appraise the contribution of Bangabandhu Sheikh Mujibur Rahman	United Front (Jukto- Front).Twenty One point Programme. Growing Disparity between East and West Pakistan and Struggle for Autonomy under Military Rule in Pakistan.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Evaluate the emergence of Bangladesh as an independent country.	Great Men and History- Role of Bangabandhu and the Emergence of Bangladesh.	Lecture, Hand/Multimedia Demonstration	Term paper, Class Test, Final Exam

Course Title	Bengali Language and Literature	Course Code	GED 117	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of the study of Bengali language and literature which opens up the world of human expression and communication. Students can improve their ethical value by this course. On this course students will not only build a detailed knowledge and understanding of literature and language, also will gain insights into the social and cultural issues that affect our lives. In this course students get the opportunity to exPOre the relationship between literature, language and society.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Determine the Bengali Spelling, Punctuations, voice change, Terminology etc. (**POI0**)

CO 2: Identify the right way to make a perfect CV, Show Cause Letter and Speech for various aspects. (**POI0**)

CO 3: Criticize all literary terms: Poems, Short Stories, Drama, Novel and dissertation. (**POI0**)

CO 4: Elucidate the knowledge of Bengali Language Movement through drama and Liberation war through novel. (**POI0**)

CO 5: Find and realize the value of own language, Learn lesson from authors write and life. (**POI0**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine the Bengali Spelling, Punctuations, voice change, Terminology etc.	Bengali Spelling, Punctuations, voice change, Terminology etc.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Identify the right way to make a perfect CV, Show Cause Letter and Speech for various aspects	CV, Show Cause Letter Writing. Preparing Speech for various aspects.	Lecture, Hand/Multimedia Demonstration	Class Test, Final Exam
Criticize all literary terms: Poems, Short Stories, Drama, Novel and dissertation.	Literary terms of Poems, Short Stories, Drama, Novel and dissertation.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Elucidate the knowledge of Bengali Language Movement through drama and Liberation war through novel.	Bengali Language Movement through drama and Liberation war through novel.	Lecture, Hand/Multimedia Demonstration	Term paper/Presentation, Class Test, Final Exam
Find and realize the value of own language, Learn lesson from authors write and life.	Learning lessons from authors writings and life.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam

Course Title	Bangladesh Studies	Course Code	GED 105	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to acquaint the students develop their foundational knowledge about Bangladesh, especially about her past, politics, religions, society, economy, culture, music, customs, etc. Apart from learning, Bangladesh Studies also seeks to help students develop themselves as proud citizens of Bangladesh.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Estimate the geographical, topographical and anthropological origin and traits of Bangladesh. (PO3)
CO 2: Illustrate the historical development of Bangladesh from ancient age to British period. (PO3)
CO 3: Assess the political perspectives like the constitution of Bangladesh,. (PO3)
CO 4: Evaluate the economical and agricultural conditions of Bangladesh. (PO3)
CO 5: Calculate the Societal, educational and Cultural settings of Bangladesh. (PO3)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Estimate the geographical, topographical and anthropological origin and traits of Bangladesh.	Geographical--Bangladesh-Geography Topography and climate and Anthropology-origin and traits of Bengalie people and those of various indigenous groups	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Illustrate the historical development of Bangladesh from ancient age to British period.	Historical-(A) Prehistory and History of the Shashanka, the Pala and the Sena up to 1203. (B)Muslim conquest in Bengal: Sultanate and Mughal period in Bengal (1204-1757). (C)British Conquest of India (1757-1947),	Lecture, Hand/Multimedia Demonstration	Class Test, Final Exam
Assess the political perspectives like the constitution of Bangladesh.	Pakistani Interregnum-The Liberation War of Bangladesh (1947-1971). Political- The Constitution of Bangladesh. The functions of the Executive, Legislative and the Judiciary, Local Government Functions, etc.	Lecture, Hand/Multimedia Demonstration	Term paper/ Presentation, Class Test, Final Exam
Evaluate the economical and agricultural conditions of Bangladesh.	Economic- Economic growth in Bangladesh. Agricultural-the importance of Agriculture to Bangladesh: Environmental-Environmental Challenges.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Calculate the Societal, educational and Cultural settings of Bangladesh.	Societal-The service Sectors: Educational- primary, secondary and tertiary. Cultural-Culture of Bangladesh: (A) Its basic characteristics, urban rural cultural differences (B) Folk Culture of Bangladesh	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam

Course Title	Sociology	Course Code	GED 155	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to introduce the scientific study of human society, culture, and social interactions.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Create sociological knowledge and skills that will enable to think critically and ingeniously about society and social issues. (PO8, PO6)

CO 2: Analyze theoretical perspectives in sociology, and assess the conceptual differences among them. (PO3)

CO 3: Evaluate the impact of culture and socialization on individuals and groups. (PO3, PO8)

CO 4: Develop knowledge on multiple types of social institutions and their evolution over time. (PO8, PO6)

CO 5: Apply sociological knowledge to interpret current events. (PO3, PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Create sociological knowledge and skills that will enable to think critically and ingeniously about society and social issues.	Introduction to Sociology. Practical Value/Uses of Sociology, Micro and Macro Sociology. Development of Sociology.	Lecture, Hand/Multimedia Demonstration, Group Work	Class Tests, Assignment, Final Exam
Analyze theoretical perspectives in sociology, and assess the conceptual differences among them.	Cotributions of Auguste Comte, Karl Marx and Max Weber to the Development of Sociology.	Lecture, Hand/Multimedia Demonstration, Group Work	Class Tests, Assignment, Final Exam
Evaluate the impact of culture and socialization on individuals and groups.	Culture and Civilization: Concept, Characteristics and Functions. Socialization: Concept, Types and Agencies of Socialization. Theories of Socialization.	Lecture, Hand/Multimedia Demonstration, Group Work	Class Tests, Assignment, Final Exam
Develop knowledge on multiple types of social institutions and their evolution over time.	Social Organization and Social Problem. Family: Form and Functions of Family. Social Stratification. Social Processes.	Lecture, Hand/Multimedia Demonstration, Group Work	Class Tests, Assignment, Final Exam
Apply sociological knowledge to interpret current events.	Industrial Revolution, Capitalism and Socialism. Urbanization and City Development. Work and Economic Life. Climate Change and Global Risk.	Lecture, Hand/Multimedia Demonstration, Group Work	Class Tests, Assignment, Final Exam

Course Title	Economics	Course Code	GED 157	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of importance and Relevance of Studying in Economics by the Social Worker, National Income, Labor and Productivity, Bangladesh Economy.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge of the fundamental concept of economics both in micro and macro manner. (PO6)
CO 2: Compute basic mathematical term of economics. (PO6)
CO 3: Analyze basic market economy. (PO6)
CO 4: Design of the basics of micro and macro level of market economy. PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge of the fundamental concept of economics both in micro and macro manner.	Basics of economics: micro, macro. Water and Health, Community participation.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute basic mathematical term of economics.	Economic decision. Graphs. Theory and usefulness of theories. Opportunity Cost: production possibility schedule.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze basic market economy.	Production. Demand, elasticity of demand. Supply, elasticity of supply. Capital: annual cost of capital, the stock marker. Cost: Marginal cost, average cost. Profit: normal profit and pure profit.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design the basics of micro and macro level of market economy.	Economic Growth. Monopoly, oligopoly. Labor and productivity. Wage: theory of wages. Welfare economics: concept and application. Features of Bangladesh economy: Agriculture, Industry, Trade, Foreign Aid.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Government	Course Code	GED 159	Credit Hour	2.0

		Contact Hours/week	2.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of Governance, Bureaucracy, Issues of Accountability, Development Partners and the Agenda for Good Governance, Globalization, Economic Reform and supply and Demand Side of Good Governance, The Role of Politics in Governance.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge of the theories of government and public policies. (PO6)
CO 2: Analyze the system of public administration. (PO6)
CO 3: Explain the existing social system in view of governance practice. (PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge of the theories of government and public policies.	Concept of governance and development. Paradigms of governance: Academic Paradigm - Western Model of Governance i.e. Classical Democracy, Protective Democracy, Developmental Democracy, Direct Democracy. Aid Agency Driven Paradigm: UNDP Model of Good Governance, World Bank Model of Good Governance,	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze the system of public administration.	Characteristics and Notion of Good Governance. Governance Theories: Experience of Good Governance. Critical Definition of Globalization.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain the existing social system in view of governance practice.	Globalization Theory: Theory of Realism, Theory of Liberalism, Theory of Interdependence. Multidimensional features of Globalization. Globalization: Bangladesh Perspective.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Basic science

Course Title	Physical Optics, Waves & Oscillation, Heat & Thermodynamics	**Course Code**	PHY 175	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of waves and oscillation, Optical Physics, heat and thermodynamic issues, energy distribution of oscillatory system, situation under different condition (like damping), two-body oscillatory system, different measurable parameters of different pendulums, Different properties of light such as interference, diffraction, polarization with the devises and tools that are used to study the properties along with the experimental methods, thermal Physics with Kinetic theory of gases, different thermodynamic process, laws and functions with Mathematical orientations with Mathematical development.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: **Explain** Oscillatory system, behavior and properties of light, a gaseous and a thermo related system. **(PO1, PO4)**

CO 2: Describe the steps take place in behaviors of light (interference, diffraction, polarization, aberration), and thermodynamic processes and respective laws separately. **(PO4, PO2)**

CO 3: nearly similar properties of light, multi-body to single body oscillatory system. **(PO1, PO02)**

CO 4: Design an experiment for optical event like interference and diffraction and etc. **(PO3, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain Oscillatory system, behavior and properties of light, a gaseous and a thermo related system	Simple Harmonic Oscillation, Simple pendulum, Tensional pendulum, damped oscillation, forced oscillation, resonance, Spring-mass system, Interference, Diffraction, Polarization, Aberration, Kinetic theories of gases, Maxwell's functions	Lecture, Hand out	Class Tests, Assignment, Final Exam
Describe the steps take place in behaviors of light (interference, diffraction, polarization), and thermodynamic processes and respective laws separately	Interference, Diffraction; Zeroth, First, Second and Third laws of thermodynamic with different processes	Lecture, Hand out	Class Tests, Assignment, Final Exam
Compare nearly similar properties of light, multi-body to single body oscillatory system	spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration; reversible and irreversible processes; single body to two body oscillation	Lecture, Hand out	Class Tests, Assignment, Final Exam
Design an experiment for optical event like interference and diffraction and etc	Young's double slit experiment, Newton's rings, Diffraction by single slit, diffraction at double slit and N-slits	Lecture, Hand out	Class Tests, Assignment, Final Exam

Course Title	Structure of matter, Electricity, Magnetism & Modern Physics	Course Code	PHY 177	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of electricity such as different laws (Coulomb's law, Gauss' law and etc) and their respective application with Mathematical incorporation and magnetism such as different laws (Biot-Savart law, Ampere's law and etc) and their respective application with Mathematical incorporation besides .Also the topics of Modern Physics (Photoelectric effect, Compton effect) are included along with the topics of general relativity and nuclear Physics separately. Some gravitation and non-relativistic motion related topics are also covered.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain anon-relativistic motion and planetary system, preliminary level nuclear aspects and radioactive properties, general relativistic features, electric system and magnetic system **(PO1, PO4)**

CO 2: Determine the physical parameters (observables) of a dynamic object both in non-relativistic and relativistic motion separately. **(PO1, PO3)**

CO 3: Compare between - classical to quantum system, different types of nuclear reactions, a relativistic to a non-relativistic system. **(PO2, PO10)**

CO 4: Design an experimental process. **(PO4, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain non-relativistic motion and planetary system, preliminary level nuclear aspects and radioactive properties, general relativistic features, electric system and magnetic system	Linear and angular momentum for single and system of particles with conservation, nuclear constituents, radioactivity, uncertainty principle, postulates of quantum mechanics, postulates of relativity with transformation equations, electrical force, field, flux, potential, magnetic force, field, flux	Lecture, Hand out	Class Tests, Assignment, Final Exam
Determine the physical parameters (observables) of a dynamic object both in non-relativistic and relativistic motion separately	Momentum of object under linear and angular motion separately; velocity, time period, height of satellites, capacitance of capacitor, field and potential (change) of a charged system	Lecture, Hand out	Class Tests, Assignment, Final Exam
Compare between - classical to quantum system, different types of nuclear reactions, a relativistic to a non-relativistic system.	Galilean relativity, Lorentz transformation, introductory quantum mechanics, nuclear fission and nuclear fusion	Lecture, Hand out	Class Tests, Assignment, Final Exam
Design an experimental process	Compton effect, photoelectric effect	Lecture, Hand out	Class Tests, Assignment, Final Exam

Course Title	Engineering Physics Lab	Course Code	PHY 176	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of room condition (lighting) for focal length determination experiment, supporting tools (slide calipers, screw gauge and etc), determination of the radius of curvature of a plano-convex lens by Newton's ring method, determining rigidity modulus of a material and determination of the spring constant and the effective mass of a loaded spring and etc., error calculation in the experiment relating to line frequency by Lissajous figures using an oscilloscope and determination of frequency of a tuning fork.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: **List** down the requirements for doing an experiment. **(PO1, PO5)**

CO 2: **Relate** the underlying theory to the experiment. **(PO2, PO4)**

CO 3: **Calculate** the experimental value. **(PO2, PO9)**

CO 4: **Judge** the error made in the experiment as percentage and therefore finding the causes of error held. **(PO3, PO10)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
List down the requirements for doing an experiment	Room condition (lighting) for focal length determination experiment, supporting tools (slide calipers, screw gauge and etc)	Practical Experiment/ Lecture	Quiz, Reporting, Viva-voce
Relate the underlying theory to the experiment	Determination of the radius of curvature of a plano-convex lens by Newton's ring method	Practical Experiment/Demonstration/Lecture	Quiz, Reporting, Viva-voce, Assignment
Calculate the experimental value	Determining rigidity modulus of a material and determination of the spring constant and the effective mass of a loaded spring and etc.	Practical Experiment/Demonstration/Lecture	Quiz, Reporting, Viva-voce, Assignment
Judge the error made in the experiment as percentage and therefore finding the causes of error held	Error calculation in the experiment relating to line frequency by Lissajous figures using an oscilloscope and determination of frequency of a tuning fork	Practical Experiment/Demonstration/Lecture	Quiz, Reporting, Viva-voce, Assignment

Course Title	Engineering Chemistry	Course Code	CHE 175	Credit Hour	3.0

		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of Chemistry with a view to enhancing the knowledge of Engineers in the field fundamental and material science.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Comprehend the structure of atoms and the models associated with them. **(PO1)**

CO 2: Differentiate the physico-chemical properties of different materials used in industries. **(PO1, PO4)**

CO 3: Develop knowledge of the formation of solutions and their relationship with the physical states. **(PO1)**

CO 4: Apply the knowledge to find out ways for optimum reaction condition for higher yield with shorter time. **(PO1)**

CO 5: Develop knowledge of periodicity of elements and their properties can derive the periodic table. **(PO1, PO4)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Comprehend the structure of atoms and the models associated with them.	Bohr's atom model, Heisenberg's uncertainty principle. Quantum Number and their significance. Electronic configurations of atoms.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Differentiate the physico-chemical properties of different materials used in industries.	Introduction and types of Chemical bonds. Physico-chemical properties of compounds based on chemical bonds. Valence bond theory molecular orbital theory, shape of molecules.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge of the formation of solutions and their relationship with the physical states.	Modern concepts of acids and base. Different types of solutions, Units of concentration. Properties of dilute solution.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply the knowledge to find out ways for optimum reaction condition for higher yield with shorter time.	Thermo chemistry and types of reaction. Thermo chemical laws. Ectrochemistry: voltaic cells, electrolytic cells. Colloids and colloidal solution. Chemical Equilibrium, Le Chatelier Principle. Ionic equilibria and pH concept.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge of periodicity of elements and their properties can derive the periodic table.	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.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Engineering Chemistry Lab	**Course Code**	CHE 176	**Credit Hour**	1.5

		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss volumetric analysis: acid-base titration, oxidation-reduction titrations, pH titrations, determination of Cu, Fe and Ca volumetrically, determination of Ca and Mg in water.				
Course Learning Outcomes (COs): Upon completion of the course, the students will be able to – CO 1: Analyze volumetric titrations. (**PO1, PO4, PO12**) CO 2: Determine Copper, Iron, and Calcium volumetrically. (**PO1, PO4**) CO 3: Determine Calcium and Magnesium in water. (**PO1, PO4**)					

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze volumetric titrations.	Volumetric analysis: acid-base titration, oxidation-reduction titrations, pH titrations.	Lecture, Experimental Demonstration	Assignments, Report, Viva, Final Quiz
Determine Copper, Iron, and Calcium volumetrically.	Determination of Cu, Fe and Ca volumetrically.	Lecture, Experimental Demonstration	Assignments, Report, Viva, Final Quiz
Determine Calcium and Magnesium in water.	Determination of Ca and Mg in water	Lecture, Experimental Demonstration	Assignments, Report, Viva, Final Quiz

Mathematics

Course Title	Differential Integral Calculus and Matrices	**Course Code**	MAT 153	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss various topics of differential calculus: limit, continuity and differentiability; successive differentiation and Leibnitz's theorem; expansion of functions; indeterminate forms; partial differentiation; Euler's theorem; tangent and normal; maxima and minima of functions of single variables. Integral calculus: integration by parts; standard integrals; integration by the method of successive reduction; definite integrals; beta function; gamma function; multiple integrals. Matrices: definition of different kinds of matrices; algebra of matrices; inverse of matrix; rank and elementary transformation of matrices; solution of system of linear equations; Eigen values and Eigen vectors; Cayley-Hamilton theorem.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Analyze the operation of composition of functions and be able to apply algebraic equations. (PO1, PO4)

CO 2: Analyze linear, quadratic, power, polynomial, algebraic, rational, trigonometric, exponential, hyperbolic and logarithmic functions and sketch their graphs. (PO1, PO4)

CO 3: Design computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization. (PO4)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze the operation of composition of functions **apply** algebraic equations.	Differential calculus: Differentiation of various types of functions. expansion of functions; Limit, Evaluation of indeterminate forms by L` Hopitals rule Continuity and differentiability;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze linear, quadratic, power, polynomial, algebraic, rational, trigonometric, exponential, hyper-bolic and logarithmic functions and sketch their graphs.	Maximum and minimum values of functions of single variable	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.	Inverse of matrix. Rank and elementary transformation of matrices, Solution of systems of linear equations: Gaussian elimination method and Gauss – Jordan Elimination method. Cayley-Hamilton theorem. Eigenvalues and eigenvectors;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Differential Equations and Statistics	Course Code	MAT 155	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss various topics of Ordinary differential equation: formation of differential equations, Partial differential equation, and Statistics.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Solve a variety of first order differential equations selecting from a variety of techniques **(PO1, PO4)**
CO 2: Analyze certain physical problems (tank flow, compound interest, mechanical and electrical vibration) **(PO1, PO4)**
CO 3: Discuss how variability affects the data collected and used for making engineering decisions **(PO4)**
CO 4: Identify the role that statistics can play in the engineering problem-solving process.

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Solve a variety of first order differential equations selecting from a variety of techniques	Degree and order of ordinary differential equations, Linear, nonlinear differential equation. Variable Separation Method. Homogeneous Method. Exact differential equation.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze certain physical problems (tank flow, compound interest, mechanical and electrical vibration)	Orthogonal Trajectories. Linear Equation. Bernoulli's Equation. System of differential equations. UC method. Cauchy Euler Equation. Formation of Partial differential equations. Lagrange method.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Discuss how variability affects the data collected and used for making engineering decisions	Measures of central tendency: arithmetic mean, Geometric mean, Harmonic mean. Median, mode. Measures of variation: standard deviation, moments, skewness and kurtosis.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Identify the role that statistics can play in the engineering problem-solving process.	Statistics. Binomial, poisson and Normal distribution.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Coordinate Geometry and Vector analysis	Course Code	MAT257	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	Co-ordinate Geometry: 2-Dimentional co-ordinate geometry: change of axes transformation of co-ordinates, simplification of equations of curves. 3-Dimentional co-ordinate geometry: system of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines. Vector analysis: scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence and independence of vectors; definition of line, surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments. (**PO1, PO4**)

CO 2: Design a physical interpretation of the gradient, divergence, curl and related concepts. (**PO4**)

CO 3: Apply the relationship between parallel and perpendicular lines. (**PO1**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments.	Co-ordinate Geometry: 2-Dimentional co-ordinate geometry: change of axes transformation of co-ordinates, simplification of equations of curves. 3-Dimentional co-ordinate geometry: system of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design a physical interpretation of the gradient, divergence, curl and related concepts.	Definition of line ,surface and volume integral; gradient, divergence and curl of point functions; Gauss's theorem, Stoke's theorem, Green's theorem and their applications	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply the characteristics of scalar and vector valued functions and master these in calculations	Scalars and vectors, equality of vectors; addition and subtraction of vectors; multiplication of vectors by scalars; position vector of a point; scalar and vector product of two vectors and their geometrical interpretation; triple products and multiple products of vectors; linear dependence and independence of vectors;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Fourier Analysis and Laplace Transformation	Course Code	MAT-259	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Familiarize the students with the concept of Fourier transform & Fourier series. (**PO1**)

CO 2: Analyze Laplace transform of a function from the definition of a Laplace transform and **apply** the Laplace transform of the exponential, cosine and sine functions. (**PO1, PO4**)

CO 3: Conduct Laplace transform of derivatives, integrals and general or complete solutions to linear ODEs. (**PO1, PO4**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Familiarize the students with the concept of Fourier transform & Fourier series.	Real and complex form of Fourier series Finite transform; Fourier Integral. Fourier transforms and their uses in solving boundary value problems of wave equations.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze Laplace transform of a function from the definition of a Laplace transform and **apply** the Laplace transform of the exponential, cosine and sine functions.	Laplace Transforms: Definition; Laplace transforms of some elementary functions.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Conduct Laplace transform of derivatives, integrals and general or complete solutions to linear ODEs.	Laplace transforms of derivatives. Sufficient conditions for existence of Laplace transform; Inverse Laplace transforms.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Basic Engineering

Course Title	Engineering Mechanics	Course Code	CE 101	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of engineering mechanics such as — Coplanar and non-coplanar force systems, moments, analyses of two dimensional frames and trusses, friction, flexible chords, centroids of lines, areas and volumes, moments of inertia of areas and masses. This course also intended to provide fundamental understanding of the principles of plane motion, work and energy, impulse and momentum as well as virtual work principle for rigid bodies.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the basic principles and terminology of structural mechanics by identifying coplanar, non-coplanar forces and moments in structural system. (PO1, PO2)

CO 2: Solve 2D & 3D Frames and different type of Trusses. (PO2)

CO 3: Calculate impulse, momentum, moments of inertia. (PO2)

CO 4: Find centroids of 1D, 2D & 3D structural element. (PO2)

CO 5: Explain the basic working principles of flexible chords, plane motion, friction and virtual work principle. (PO1, PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the basic principles and terminology of structural mechanics by identifying coplanar, non-coplanar forces and moments in structural system.	Theories and examples of Coplanar concurrent &non concurrent and non-coplanar force systems, moments in structural system.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Solve 2D & 3D Frames and different type of Trusses.	Analysis of two dimensional frames and trusses.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Calculate impulse, momentum, moments of inertia.	Work and energy, impulse and momentum of static and kinetic system.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Find centroids of 1D, 2D & 3D structural element.	Calculation of the centroids of lines, areas, volumes and masses.	Classroom instruction, Practical example	Assignment, Final Exam
Explain the basic working principles of flexible chords, plane motion, friction and virtual work principle.	Theories and examples of different types of chords, horizontal and inclined plane motion. Friction through planes. Basic concept of Virtual work principle.	Lecture, Hand/Multimedia Demonstration	Term paper/Presentation, Class Test, Final Exam

Course Title	Surveying	Course Code	CE 103	Credit Hour	3.0
		Contact Hours/week	2.5	Prerequisite	N/A
Synopsis	Reconnaissance survey; linear measurements; traverse survey; triangulation, leveling and contouring; calculation of areas and volumes; problems on heights and distances; curves and curve ranging, transition curve, vertical curves; astronomical surveying: definition, instruments, astronomical corrections, systems of time; Photogrammetry: introduction of terrestrial photography, aerial photography, reading of photo mosaic, scale; project surveying; errors in surveying; remote sensing; introduction to geographic information system (GIS) and global positioning system (GPS).				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Emphasize the basic principles and fundamental concept of surveying. **(PO1)**

CO 2: Demonstrate the use of basic surveying tools. **(PO5)**

CO 3: Quantify the error from a field survey, and the methods to adjust them. **(PO4, PO2)**

CO 4: Apply drawing techniques in the development of a topographic map. **(PO5)**

CO 5: Familiar with geographic information system (GIS) and global positioning system (GPS). **(PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Emphasize the basic principles and fundamental concept of surveying.	Fundamental concepts of Surveying. Definitions of various types of surveying, Calculation of Area, Measurement of Volume.	Lecture, Hand/Multimedia Demonstration, Practical Exercise.	Assignment, Viva, Quizzes

Demonstrate the use of basic surveying tools.	Chain Surveying, Compass, Level, Theodolite, Traverse Surveying, etc.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Quantify the error from a field survey, and the methods to adjust them.	Accuracy and errors: Sources of errors, Kinds of error, Accuracy in Surveying	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Apply drawing techniques in the development of a topographic map.	Plain Table Surveying, Contouring , Photogrammetric surveying,	Lecture, Demonstration	Assignment, Viva, Quizzes
Be Familiar with geographic information system (GIS) and global positioning system (GPS).	Remote sensing; introduction to geographic information system (GIS) and global positioning system (GPS).	Lecture, Demonstration	Assignment, Viva, Quizzes

Course Title	Engineering Materials	**Course Code**	CE 201	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of civil engineering and construction materials such as —aggregate, brick, cement; sand, lime, mortars; concrete; concrete mix design; ferrocement , wood, wood products; advanced fiber reinforced polymer (FRP) composites. This course also covers stress and strain response of solid materials; plane stress and strain condition; identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials; time dependent strain response of these materials due to different types of loadings; mathematical and simple rheological modeling for prediction of creep behavior; corrosion and prevention of steel in RC structures.				
Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to – CO 1: Develop knowledge how to use civil engineering materials for sustainable infrastructure **(PO1, PO4,PO2)** CO 2: Design and use materials in engineering purpose. **(PO1, PO3)** CO 3: Develop knowledge of the stresses and the deformations of materials under loading. **(PO1)** CO 4: Implement structural repair method with appropriate materials. **(PO1, PO2)** CO 5: Understand steel corrosion and its prevention methods. **(PO2)**					
Course Learning Outcomes (COs)		**Course Content**		**Teaching Learning Strategy**	**Assessment Strategy**
Develop knowledge how to use civil engineering materials for sustainable infrastructure.		Major engineering aspects of Aggregate, brick, cement; sand, lime, mortars; concrete; concrete mix design; ferrocement, wood, wood products; advanced fiber reinforced polymer (FRP)		Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

	composites.		
Design and **use** materials in engineering purpose.	Aggregate blending, mortar mix and concrete mix design for different categories of use.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge of the stresses and the deformations of materials under loading.	Stress and strain response of solid materials; plane stress and strain condition; identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Implement structural repair method with appropriate materials.	Structural repairing of civil engineering structure (RCC structure) with ferrocement and FRP using contemporary technique.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge steel corrosion and its prevention methods	Corrosion and prevention of steel in RC structures, offshore structures and ground applications.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Engineering Geology and Geomorphology	**Course Code**	CE 203	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	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.				
Course Learning Outcomes (COs): Upon completion of the course, the students will be able to – CO 1: Identify the most important rocks and minerals and interpret geological maps with an emphasis on making construction decisions.**(PO1, PO6)** CO 2: Determine the main processes that occur in rivers, and the means for observing them. **(PO1, PO6)** CO 3: Analyze and evaluate data and appropriately solve problems both technical and environmental.**(PO1, PO6)** CO 4: Assess some of the techniques for analysis of channel morphology and processes and understand stream response to natural and human induced environmental change. **(PO1, PO6)**					

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Identify the most important rocks and minerals and interpret geological maps with an emphasis on making construction decisions.	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.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Determine the main processes that occur in rivers, and the means for observing them.	Channel development; channel widening; valley shape; stream terraces; alluvial flood plains; deltas and alluvial fans; channel morphology; channel patterns and the river basin	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze and evaluate data and appropriately solve problems both technical and environmental.	Structural geology; faults; types of faults; fold and fold type; domes; basins; erosional process; quantitative analysis of erosional land forms.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Assess some of the techniques for analysis of channel morphology and processes and understand stream response to natural and human induced environmental change.	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.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Mechanics of Solids I	Course Code	CE 251	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	CE 101
Synopsis	This course has been designed to discuss the major topics of solid mechanics such as — Concepts of stress and strain, constitutive relationships, deformations due to tension, compression and temperature change, beam statics: reactions, axial force, shear force and bending moments, axial force, shear force and bending moment diagrams using method of section and summation approach, elastic analysis of circular shafts, solid noncircular and thin walled tubular members subjected to torsion, flexural and shear stresses in beams, shear centre as well as thin walled pressure vessels.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge about the terminology and concepts of stress and strain and constitutive relationships. (PO1)

CO 2: Estimate deformation. (PO2)

CO 3: Draw axial force, shear force and bending moment diagram of beam. (PO2)

CO 4: Analyze circular shaft and thin walled pressure vessel. (PO2)

CO 5: Calculate flexural and shear stresses in beams and their implication. (PO1, PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge about the terminology and concepts of stress and strain and constitutive relationships.	Theories and basic concepts of stress and strain, constitutive relationships.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Estimate deformation.	Deformation calculation due to tension, compression and temperature change.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Draw axial force, shear force and bending moment diagram of beam.	Beam statics: reactions, axial force, shear force and bending moments, axial force, shear force and bending moment diagrams using method of section and summation approach.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze circular shaft and thin walled pressure vessel.	Elastic analysis of circular shafts, solid noncircular and thin walled tubular members subjected to torsion	Classroom instruction, Active learning, Practical example	Assignment, Final Exam
Calculate flexural and shear stresses in beams and their implication.	Flexural and shear stresses calculation of beams under different loading and support condition and their significance in solid mechanics.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam

Course Title	Mechanics of Solids II	Course Code	CE 253	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	CE 251
Synopsis	This course has been designed to discuss the major topics of solid mechanics such as — Symmetric and unsymmetrical bending of beams; stress transformation, failure criteria; beam deflection by direct integration and moment area method; buckling of columns; elastic strain energy and external work; cable and cable supported structures; bolted, riveted and welded joints.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge of the basic principles of symmetric and unsymmetrical bending of beams. **(PO1)**

CO 2: Use stress transformation method for failure analysis. **(PO1, PO2)**

CO 3: Calculate beam deflection. **(PO2)**

CO 4: Analyze cable and cable supported structures and different types of joints. **(PO2)**

CO 5: Explain the basic working principles behind column buckling, elastic strain energy. **(PO1, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge of the basic principles of symmetric and unsymmetrical bending of beams.	Theories and examples of Symmetric and unsymmetrical bending of beams	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Use stress transformation method for failure analysis.	Theory of stress transformation, failure criteria. Mohr's circle.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Calculate beam deflection.	Beam Deflection calculation by direct integration, singularity function, conjugate beam and moment area method	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze cable and cable supported structures and different types of joints.	Calculation of cable and cable supported structures. Analysis of bolted, riveted and welded joints.	Classroom instruction, Active learning, Practical example	Assignment, Final Exam
Explain the basic working principles behind column buckling, elastic strain energy.	Theories and examples of column buckling. Basic concept of elastic strain energy.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam

Course Title	Fluid Mechanics	Course Code	CE 241	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	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, venture meter weir. Pipe flow problems – pipes in series and parallel, branching pipes, pipe networks.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Familiar with the terminology associated with fluid mechanics and principals of flow rates and velocity measurement. **(PO1)**

CO 2: Use fluid properties correctly to solve problems. **(PO1)**

CO 3: Solve (analytical and numerical) viscous flow problems. **(PO2)**

CO 4: Compute forces on bodies in fluid flows. **(PO2)**

CO 5: Analyze pipe flow network and losses in pipe flow. **(PO2, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Be Familiar with the terminology associated with fluid mechanics.	Development and scope of fluid mechanics.	Lecture, Hand/Multimedia Demonstration, Practical Exercise.	Assignment, Viva, Quizzes
Use fluid properties correctly to solve problems.	Fluid properties, fluid statics, kinematics of fluid flow, fluid flow concepts and basic equations.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Solve analytical and numerical viscous flow problems.	Similitude and dimensional analysis, steady incompressible flow in pressure conduits, laminar and turbulent flow, general equation for fluid friction.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Compute forces on bodies in fluid flows.	Fluid measurement: Pilot tube, orifice, mouthpiece, nozzle, venture meter weir.	Lecture, Demonstration	Assignment, Viva, Quizzes
Analyze pipe flow network and losses in pipe flow.	Empirical equations for pipe flow, minor losses in pipe flow. Pipe flow problems – pipes in series and parallel, branching pipes, pipe networks.	Lecture, Demonstration	Assignment, Viva, Quizzes

Course	Fundamentals of Electrical	Course Code	EEE 241	Credit Hour	3.0

Title	Engineering	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of electrical units and standards, electrical network and circuit solution, sinusoidal single phase RLC circuits, and alternating current.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Calculate electrical network and circuit solution. (POI)
CO 2: Develop knowledge on RLC circuits. (POI)
CO 3: Develop knowledge on alternating current. (POI)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Calculate electrical network and circuit solution.	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.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam
Develop knowledge on RLC circuits.	Sinusoidal single phase RLC circuits: phasor algebra, balanced three phase circuits.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge on alternating current.	Alternating current: Instantaneous and rms values of current, voltage, power, average power, introduction to transformer and induction motors.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course	Numerical Methods and	Course Code	CE 209	Credit Hour	2.0

Title	Analysis	Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss Motivation and errors in numerical techniques. Solution of algebraic and transcendental equations: method of iteration, False Position method, Newton-Rhapson 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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Demonstrate common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems. (PO1)

CO 2: Apply numerical methods to obtain approximate solutions to mathematical problems. (PO1)

CO 3: Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations. (PO2)

CO 4: Analyze and evaluate the accuracy of common numerical methods. (PO4)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Demonstrate common numerical methods	Solution of algebraic and transcendental equations: method of iteration, False Position method, Newton-Rhapson method;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply numerical methods to obtain approximate solutions to mathematical problems	Solution of simultaneous linear equations, Iteration method, Interpolation: diagonal and horizontal difference, differences of a polynomial, Integration, Solution of ordinary differential equations.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Derive numerical methods for various mathematical operations	Iteration method, Interpolation: diagonal and horizontal difference, differences of a polynomial, Integration, Solution of ordinary differential equations.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze and evaluate the accuracy of common numerical methods.	Least squares approximation of functions: linear and polynomi al regression, fitting exponential and trigonometric functions.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Practical Surveying	Course Code	CE 106	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of practical surveying, such as — Linear and angular measurement techniques; traverse surveying; leveling and contouring; curve setting; tacheometry; project surveying; modern surveying equipment and their applications.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Delineate different concepts and measurement technique for surveying. (**PO4**)

CO 2: Demonstrate the ability to use modern surveying instruments to learn traversing, leveling, contouring curve setting technique and their application. (**PO4, PO12, PO5**)

CO 3: Develop concepts of tacheometry and its application. (**PO4, PO12, PO5**)

CO 4: Apply the modern surveying concepts to practical projects. (**PO12, PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Delineate different concepts and measurement technique for surveying.	Linear and angular measurement techniques for reconnaissance, chain survey, plane table survey, house setting	Lecture, Hand/ Multimedia Demonstration, field application	Assignments/Group work, Class tests, Final Quiz, Viva
Demonstrate the ability to use modern surveying instruments to learn traversing, leveling, contouring curve setting technique.	Ordinary leveling, reciprocal leveling, contouring, traversing, trigonometrically survey, traverse surveying; leveling and contouring; curve setting.	Lecture, Hand/Multimedia Demonstration, field application	Assignments/Group work, Class tests, Final Quiz, Viva
Develop concepts of tachometry and its application.	Tacheometry.	Lecture, Hand/Multimedia Demonstration, field application	Assignments/Group work, Class tests, Final Quiz, Viva
Apply the modern surveying concepts to practical projects.	Project surveying; modern surveying equipment and their applications.	Lecture, Hand/Multimedia Demonstration, field application	Assignments/Group work, Class tests, Final Quiz, Viva

Course Title	Computer Programming Lab	Course Code	CSE 252	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss 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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Describe concepts of programming, algorithm and flow chart. (**PO4, PO2, PO5**)

CO 2: Develop knowledge about functions, control statement, arrays. (**PO4, PO2**)

CO 3: Explain variables, functions and object oriented concept, such as polymorphism, encapsulation and inheritance. (**PO2**)

CO 4: Evaluate Civil Engineering related problems using programming. (**PO4, PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Describe concepts of programming, algorithm and flow chart.	Introduction to C++, algorithms such as, quick sort, bubble sort	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Develop knowledge about functions, control statement, arrays.	Element of structured programming language: constants, variables, data types, operators, expression, Formatted input/output Functions, control statement, arrays, strings, functions, pointers and file management.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Explain variables, functions and object oriented concept, such as polymorphism, encapsulation and inheritance.	Basic concepts of structured and object oriented programming, loops, conditional statements, operator overloading, templates.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Evaluate Civil Engineering related problems using programming.	Solving problems related to real life problem such as, SFD and BMD of beam, point load and UDL calculation, mechanics, numerical solution of equation of motion etc.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam

Course Title	Civil Engineering Drawing	Course Code	CE 102	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of lines and lettering, plane geometry, drawing of isometric view, developments of cube, pyramid, cone, cylinder, plan, elevations and sections of one storied and duplex building.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop fundamental knowledge about plane geometry and drawing of linear and curved geometric figures. (**PO1**)

CO 2: Explain the pattern of views of different solid geometry. (**PO4**)

CO 3: Apply conceptual knowledge of different shapes of a building. (**PO1, PO4**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop fundamental knowledge about plane geometry and drawing of linear and curved geometric figures.	Plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, parabola, hyperbola.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz
Explain the pattern of views of different solid geometry.	Solid geometry: concept of isometric view and oblique view, theory of projections, drawing of isometric view of 3d objects such as cube, prism, pyramid, cone and cylinder, projections of cube, prism, cone, cylinder, developments of cube, pyramid, cone, cylinder.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz
Apply conceptual knowledge of different shapes of a building.	Plan, elevations and sections of one storied and duplex building.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz

Course Title	Computer Aided Drafting	Course Code	CE 104	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of advanced civil engineering drawing in Auto CAD- isometric view, plan and section of an ideal building, drawings of various types of shallow footings, shallow foundation layout, pile foundation and pile layout drawing, column layout and column drawing, beam drawing and beam layout, drawing of slab detailing, drawing of septic tank, drawing of roof top tank, box and arch culvert drawing, truss drawing and community overhead tank drawing.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain various types of civil engineering drawings and use of Auto CAD software. (**PO1, PO4**)

CO 2: Depict various types of civil engineering drawings and use of Auto CAD software. (**PO9, PO7**)

CO 3: Compare civil engineering hand drawing with civil engineering drawing in Auto CAD. (**PO9, PO6**)

CO 4: Design introduction of various types of shallow footings, pile foundation, column, beam, slab detailing, septic tank, roof top tank, box and arch culvert, truss and community overhead tank. (**PO3, PO6**)

CO 5: Apply civil engineering drawing in Auto CAD. (**PO2, PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain various types of civil engineering drawings and use of Auto CAD software	Civil engineering drawing in Auto CAD- isometric view, plan and section of an ideal building, drawings of various types of shallow footings, pile foundation, column layout and drawing, beam drawing and layout, slab detailing, drawing of septic tank,	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Depict various types of civil engineering drawings and use of Auto CAD software	Emphasis on civil engineering drawing technique in Auto CAD software	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compare civil engineering hand drawing with civil engineering drawing in Auto CAD	Comparison of civil engineering hand drawing with civil engineering drawing in Auto CAD.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design introduction of various types of civil engineering structures.	Detailing of various types of shallow footings, pile foundation, column, beam, slab detailing, septic tank, roof top tank, box and arch culvert, truss and community overhead tank in AutoCAD.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply civil engineering drawing in AutoCAD.	Auto CAD application of various types of shallow footings, pile foundation, column, beam, slab detailing, septic tank, roof top tank, box and arch culvert, truss and community overhead tank	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Workshop Sessional	Course Code	CE 108	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of basic engineering such as Carpentry Shop (3/2 hours per week) Wood working tools, Machine Shop (3/4 hours per week) Kinds of tools, Welding Shop (3/4 hours per week) Methods of metal joints.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Estimate and detail the procedure of estimating a wooden structure. (PO4)

CO2: Detect the defects of timber and their problems. (PO4)

CO3: Select the correct joint and make a specific job using Carpentry tools. (PO5)

CO4: Produce a regular shape of a given wood as instructed individually. (PO4)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Estimate and **describe** the procedure of estimating a wooden structure.	Types of sawing; Common cuts in wood works;	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Detect the defects of timber and their problems.	Defects of timber; Commercial forms of timber. Characteristics of good timber	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Select the correct joint and **make** a specific job using Carpentry tools.	Types of joint, Use of fastening; Shop practice: Practical job, planning and estimating of a given job.	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Produce a regular shape of a given wood as instructed individually.	Wood working tools; Wood working machine: Band saw, scroll saw, circular saw, jointer, thickness planer, disc sander, wood lathe.	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva

Course Title	Details of Construction Lab	Course Code	CE 202	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of construction details, such as —Types of building, components of a building, design loads, framed structure and load bearing wall structure; foundations: shallow foundation and deep foundation, brick masonry: types of brick, bonds in brickwork, supervision of brickwork, brick laying tools, defects and strength on brick masonry, load bearing and non-load bearing walls, cavity walls, partition walls; lintels and 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; house plumbing: water supply and wastewater drainage.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Delineate different types of buildings, design loads, bearing capacity of soil, Standard Penetration Test. (PO1)

CO 2: Depict different types of foundations, defects and strengths of masonry structures, load bearing and non-load bearing walls. (PO9, PO12)

CO 3: Develop concepts of formwork, plastering, pointing, painting, distempering, sound installation, house plumbing. (PO12, PO6)

CO 4: Apply the obtained knowledge to produce cement concrete for construction. (PO12)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Delineate different types of buildings, design loads, bearing capacity of soil.	Types of building, components of a building. Design loads, Framed structure and load bearing wall structure. Bearing capacity of soil. Standard Penetration Test.	Lecture, Hand/Multimedia Demonstration	Assignment, Multimedia Presentation, Final Exam
Depict different types of foundations.	Foundations: shallow foundation and deep foundation, site exPOration. Supervision of brickwork, brick laying tools, defects and strengths of masonry structures, typical structures in brickwork. Different types of walls-cavity walls, partition walls.	Lecture, Hand/Multimedia Demonstration	Short Viva, Assignment, Final Exam
Develop concepts of formwork, plastering, pointing, painting, distempering, sound installation, house plumbing.	Discussion on Concepts of formwork, Plastering, Pointing, Painting, Distempering. House plumbing, Construction of stairs and arches, different types of stairs. Roofs and roof covering.	Lecture, Hand/Multimedia Demonstration	Oral Exam, Assignment, Final Exam
Apply the obtained knowledge to produce cement concrete for construction.	General idea of components of cement concrete, ratio of elements, effect of water-cement ratio on compressive strength of cement concrete, different types of admixtures used in cement concrete and the role of such admixtures in quality of construction	Lecture, Hand/Multimedia Demonstration	Term paper,/presentation, Final Exam

Course Title	Engineering Materials Lab	Course Code	CE 204	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of laboratory experiments on various building materials such as-fine aggregate, coarse aggregate, cement, bricks and also on cement mortar and structural concrete. Preparation and properties of concrete. The laboratory experiments includes 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 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 and compressive strength.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Practice the material test (laboratory tests) according to ASTM requirements.**(PO4)**

CO 2: Select the appropriate materials for construction of RCC Buildings.**(PO5)**

CO 3: Describe various engineering properties of the building materials.**(PO4, PO5)**

CO 4: Prepare time schedule for casting of concrete mix.**(PO4, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Practice the material test (laboratory tests) according to ASTM requirements.	Laboratory 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 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 and compressive strength.	Lecture, Multimedia & Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Select the appropriate materials for construction of RCC Buildings.	Laboratory 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 compressive strengths of cement mortar; gradation of coarse and fine aggregates.	Lecture, Multimedia & Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Describe various engineering properties of the building materials.	Moisture content and absorption of coarse and fine aggregates; normal consistency and initial setting time of cement, testing of bricks	Lecture, Multimedia & Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Prepare time schedule for casting of concrete mix.	Concrete mixed design, design and testing of a concrete mix,	Lecture, Multimedia & Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva

Course Title	Quantity Surveying	Course Code	CE 206	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to be familiarizing with the estimation of building or construction material and also cost involved with any construction works. This course includes material estimate and cost estimate of various building component and other structures.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Select appropriate bidder of any project. **(PO5)**

CO 2: Estimate the costing of any structure as per PWD rate schedule. **(PO4, PO5)**

CO 3: Evaluate the tenders based on financial proposal.**(PO5)**

CO 4: Prepare bill of quantity (BOQ) and proposal for any project as per PWD and other rate schedule **(PO4, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Select appropriate bidder of any project.	Techniques for the estimation of building or construction material	Lecture, Multimedia and Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Estimate the costing of any structure as per PWD rate schedule.	Cost estimation of various building component and other structures.	Lecture, Multimedia and Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Evaluate the tenders based on financial proposal.	Estimation of building or construction material and also cost involved with any construction works.	Lecture, Multimedia and Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva
Prepare bill of quantity (BOQ) and proposal for any project as per PWD and other rate schedule.	Estimation of building or construction material and also cost involved with any construction works.	Lecture, Multimedia and Lab Demonstration	Assignments, Lab Report, Final Quiz, Viva

Course Title	Structural Mechanics Lab	Course Code	CE 208	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of 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 center; study of structural models: truss, beam frame.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop fundamental concepts about properties of mild steel by direct shear, tension and impact test. (**PO4**)

CO 2: Compute stress and other material properties of different materials or different structural element. (**PO4, PO5**)

CO 3: Analyze the behavior of beams under loading. (**PO4**)

CO 4: Apply the obtained knowledge to study structural models, truss and frames. (**PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop fundamental concepts about properties of mild steel by direct shear, tension and impact test.	Introduction to different material properties. Behavior of mild steel and its properties. Tension test of mild steel. Direct shear test of mild steel. Impact test of metal specimens.	Lecture, Lab Manual	File Assessment, Final Exam
Compute stress and other material properties of different materials or different structural element.	Compression test of timber specimens. Hardness test of metals. Slender Column Test. Helical spring test.	Lecture, Lab Manual	Short Viva, File Assessment, Final Exam
Analyze the behavior of beams under loading.	Discussion on static bending test. Determination of shear center.	Lecture, Lab Manual	Oral Exam, File Assessment, Final Exam
Apply the obtained knowledge to study structural models, truss and frames.	Study of structural models. Truss, beam-column frame.	Lecture, Hand/Multimedia Demonstration	Term Paper, Group Presentation, Final Exam

Course Title	Fluid Mechanics Lab	Course Code	CE 242	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	CE-241
Synopsis	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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Utilize basic measurement techniques of fluid mechanics.**(PO4)**

CO 2: Discuss the differences among measurement techniques, their relevance and applications.**(PO4)**

CO 3: Measure fluid pressure and relate it to flow velocity.**(PO4)**

CO 4 : Demonstrate practical understanding of friction losses in internal flows**(PO4)**

CO 5: Demonstrate the ability to write clear lab reports.**(PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Utilize basic measurement techniques of fluid mechanics.	Introduction to Lab	Lecture, Hand/Multimedia Demonstration/Lab manual	Examination/ Class Test/ Written Assignment Report
Discuss the differences among measurement techniques, their relevance and applications.	Centre of Pressure	Lecture, Hand/Multimedia Demonstration/Lab manual	Examination/ Class Test/ Written Assignment Report
Measure fluid pressure and relate it to flow velocity.	Proof of Bernoulli's Theorem, Flow Through Venturimeter	Lecture, Hand/Multimedia Demonstration/Lab manual	Examination/ Class Test/Spot Test, Case Assignment Report
Demonstrate practical understanding of friction losses in internal flows	Flow Through an Orifice, Flow over a Sharp-Crested Rectangular weir	Lecture, Hand/Multimedia Demonstration/Lab manual	Examination/ Class Test/ Written Assignment Report
Demonstrate the ability to write clear lab reports.	Flow Through an External Cylindrical Mouthpiece, Flow over a V-notch	Lecture, Hand/Multimedia Demonstration/Lab manual	Examination/ Class Test/ Written Assignment Report

Course Title	Engineering Computation Lab	Course Code	CE 304	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Engineering computation such as— 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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Determine roots and solution of equations, solution of matrix related calculation. (**PO1, PO4**)

CO 2: Explain variables, functions and object oriented concept, such as polymorphism, encapsulation and inheritance. (**PO4, PO5**)

CO 3: Compare various mathematical functions using 2D subPOts and 3D POts. (**PO5**)

CO 4: Calculate statistical outcome of large datasets, such as, annual rainfall data, traffic speed study. (**PO4**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine roots and solution of equations, solution of matrix related calculation.	Introduction to high-level computational programming tools; application to numerical analysis: basic matrix computation, solving systems of linear equations, non-linear equations, differential equations, application to engineering problems	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Explain variables, functions and object oriented concept, such as polymorphism, encapsulation and inheritance.	Basic concepts of structured and object oriented programming, loops, conditional statements.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Compare various mathematical functions using 2D subPOts and 3D POts.	Interpolation and curve fitting, numerical differentiation, numerical integration	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Calculate statistical outcome of large datasets, such as, annual rainfall data, traffic speed study.	Solving problems related to real life problem such as, rainfall study, traffic speed study, mechanics, numerical solution of equation of motion etc.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam

Course Title	Remote Sensing and GIS Lab	Course Code	CE 302	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	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, 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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Define the concepts and fundamentals of GIS. **(PO4, PO5)**

CO 2: Describe Remote Sensing concepts, physical fundaments and components and adequately use vocabulary, terminology and nomenclature of the discipline. **(PO4, PO5)**

CO 3: Practice Photo-interpretation for basic environmental and socioeconomic variables using photographs. **(PO4, PO5)**

CO 4: Develop research-based analysis utilizing main-stream GIS technology to address a scientific topic of societal concern. **(PO4, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Define the concepts and fundamentals of GIS.	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.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Describe Remote Sensing concepts, physical fundaments and adequately use vocabulary, terminology and nomenclature of the discipline.	Understand the concept of spatial data; Spatial Analysis - Raster spatial analysis, Single layer vector spatial analysis, Multi-layer Vector spatial analysis	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Practice Photo-interpretation for basic environmental and socioeconomic variables using photographs.	Spatial Analysis - Raster spatial analysis, Single layer vector spatial analysis, Multi-layer Vector spatial analysis, Attributes based analysis.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop research-based analysis utilizing main-stream GIS technology to address a scientific topic of societal concern.	Main geographical data formats, Data Acquisition: Digitizing, Editing; Vectorize, Rasterize; Managing Attribute Tables, Attribute Queries, Relational database;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Structural Analysis and Design I	Course Code	CE 351	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the analysis of statically determinate trusses and three hinge arches, influence lines, moving loads on beams, frames and trusses; cables and cable supported structures e.g. suspension bridges.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Ability to analysis and design of statically determinate truss. **(PO1, PO3)**

CO 2: Ability to draw quantitative influence line diagram for beams, frames and trusses. **(PO1, PO3)**

CO 3: Ability to determine maximum reactions, maximum shear and maximum moment due to moving load across the structure. **(PO3, PO2)**

CO 4: Design of cable supported structures e.g. suspension bridges. **(PO3, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze and **design** statically determinate trusses, arches.	Introduction to statically determinate, indeterminate, stable, unstable trusses, analysis and design of truss members.	Lecture	Class Tests, Assignment, Final Exam
Draw quantitative influence line diagram for beams, frames and trusses	Draw qualitative influence line diagram by Muller Breslau's Method.	Lecture	Class Tests, Assignment, Final Exam
Determine maximum reactions, maximum shear and maximum moment due to moving load across the structure	Maximum reactions, maximum shear and maximum moment of any structure due to moving load.	Lecture	Class Tests, Assignment, Final Exam
Design cable supported structures e.g. suspension bridges.	Analysis of cable supported structures and design of suspension bridges.	Lecture	Class Tests, Assignment, Final Exam

Course Title	Structural Analysis and Design - II	Course Code	CE 353	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	CE 351
Synopsis	This course mainly deals with analysis of indeterminate structures. It begins with a review of the topics of lateral loads such as Wind load and earthquake load. This subject is intended to provide students with a clear and thorough understanding of how to idealize and analyze statically indeterminate structure (i.e.: braced truss, portal frame, mill bent and multistoried building frame) using approximate analysis method. This is followed by detailed descriptions and demonstrations through many examples, of the analysis of the deflection component of beam, trusses and frames by virtual work method. This course is also expected to enable a good understanding of how space truss analysis is performed. Finally, force method (consistent deformation method) of structural analysis of indeterminate structure is introduced to arm the students with the necessary tools to better appreciate the real behavior of structures.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge of type, sources of lateral loads and their estimation. (PO1, PO2)

CO 2: Develop knowledge on indeterminate structure and methods of analysis. (PO1)

CO 3: Analyze the indeterminate 1D, 2D and 3D structures using approximate method and exact method. (PO3, PO2)

CO 4: Calculate the deflection of trusses, beams and frames by using unit load method (virtual work method). (PO3, PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge of type, sources of lateral loads and their estimation..	Analysis of Wind load and earthquake load	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Develop knowledge on indeterminate structure and methods of analysis	Idealization of indeterminate structure and methods of analysis.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Analyze the indeterminate 1D, 2D and 3D structures using approximate method and exact method (Force method)	Analysis of structure (i.e.: braced truss, portal frame, mill bent, multistoried building frame and space truss) using approximate analysis method and exact method (force method).	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Calculate the deflection of trusses, beams and frames by using unit load method (virtual load method).	The analysis the deflection of beam, trusses and frames by virtual work method (unit load method).	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam

Course Title	Structural Analysis and Design III	Course Code	CE 451	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to analyze the indeterminate structures and different techniques to analyze those. Analysis of statically indeterminate beams and frames by moment distribution, consistent deformation/flexibility and stiffness methods; algorithms for implementing direct stiffness method in computer; influence lines of statically indeterminate beams and frames.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept of indeterminacy and influence line of indeterminate structures. (PO1)

CO 2: Compute indeterminacy and influence line of indeterminate structures. (PO3)

CO 3: Analyze indeterminate structures. (PO3, PO2))

CO 4: Design computer application of indeterminate structures. (PO3, PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept of indeterminacy and influence line of indeterminate structures.	Fundamental concepts of indeterminacy and influence line of indeterminate structures.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute indeterminacy and influence line of indeterminate structures.	Analysis of statically indeterminate beams and frames by moment distribution method. Consistent deformation/flexibility.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Analyze indeterminate structures.	Analysis of statically indeterminate beams and frames by moment distribution method. Consistent deformation/flexibility. Analysis of statically indeterminate beams and frames by stiffness method.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design and computer application of indeterminate structures.	Analysis of statically indeterminate beams and frames by slope deflection method. algorithms for implementing direct stiffness method in computer	Active learning, Multimedia Presentation, Practical example	Class Test, Assignment, Final Exam

Course Title	Design of Concrete Structures I	Course Code	CE 355	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of concrete structures such as — 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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental behavior of reinforced concrete. **(PO1)**

CO 2: Design different types of beams. **(PO3, PO2)**

CO 3: Examine diagonal tension and torsion of beams. **(PO3)**

CO 4: Design one way slabs. **(PO3, PO2)**

CO 5: Explain the basic design principles of two-way edge supported slabs. **(PO1, PO3)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental behavior of reinforced concrete.	Theories and examples of fundamental behavior of reinforced concrete, introduction to strength design and alternate design methods.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design different types of beams.	Flexural design of beams (singly reinforced, doubly reinforced, T-beam) using strength design method. Shear Design. Bond and anchorage.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Examine diagonal tension and torsion of beams.	Design of beam under diagonal tension and torsion.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design one way slabs.	Structural Design and detailing of one way slabs.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Explain the basic design principles of two-way edge supported slabs.	Basic Theories regarding of two-way edge supported slabs: using strip and alternate methods.	Lecture, Hand/Multimedia Demonstration	Term paper/ Presentation, Class Test, Final Exam

Course Title	Design of Concrete Structures II	Course Code	CE 357	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of concrete structures such as — 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 and basic introduction to pre-stressed concrete, analysis and preliminary design of pre-stressed beam sections.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Analyze different types of floor systems and shear walls. **(PO1, PO2)**

CO 2: Design column supported slabs. **(PO3)**

CO 3: Examine uniaxial and biaxial loading effect on columns. **(PO3)**

CO 4: Design column, footing and pile cap. **(PO3, PO2)**

CO 5: Explain the basic working principles behind pre-stressed concrete through analysis of pre-stressed beam sections.**(PO1, PO3)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze different types of floor systems and shear walls.	Theories and examples of floor systems and different types of shear wall.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design column supported slabs.	Design of column supported slabs.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Examine uniaxial and biaxial loading effect on columns.	Design of columns under uniaxial and biaxial loading, introduction to slender column.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design column, footing and pile cap.	Structural Design and detailing of column, footing and pile cap. Illustrating seismic detailing.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Explain the basic working principles behind pre-stressed concrete through analysis of pre-stressed beam sections.	Basic Theories regarding pre-stressed concrete, analysis and preliminary design of pre-stressed beam sections.	Lecture, Hand/Multimedia Demonstration	Term paper/Presentation, Class Test, Final Exam

Course Title	Design of Steel Structures	Course Code	CE 359	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of steel structure design and construction such as —Behavioral principles and design of structural steel. This course also covers the design of tension members, bolted and welded connections, compression members, flexural members, design of beam-columns, design of moment connections and column bases. This course also intended to provide fundamental understanding in detailing of steel structures. All discussions are based on the current American Institute of Steel Construction (AISC) steel design specifications.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Identify the ASD and LRFD design philosophies of steel structures and have concept on limit state design. **(PO1)**

CO 2: Develop knowledge on the behavior of steel structures. **(PO1, PO2)**

CO 3: Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, beams, columns, beam-columns and connections. **(PO3, PO2)**

CO 4: Design simple steel structures based on understanding of behavior & use of code provisions. **(PO3)**

CO 5: Illustrate design of structures via detailing concepts. **(PO4, PO3)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Identify the ASD and LRFD design philosophies of steel structures and have concept on limit state design.	Steel member design philosophy according to American Institute of Steel Construction (AISC).	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Develop knowledge on the behavior of steel structures	Theories related to Design and analysis of Steel connection, Tension member, compression member, flexural member, beam-column etc.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, beams, columns, beam-columns and connections	Design and analysis of Steel connection, Tension member, compression member, flexural member, beam- column etc. according to AISC specification.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Design simple steel structures based on understanding of behavior & use of codal provisions.	Design and analysis of structural steel members for combined load actions using AISC.	Classroom instruction, Active learning	Project, Assignment, Final Exam
Illustrate design of structures via detailing concepts	Introduction to detailing of individual steel members.	Classroom instruction, Active learning,	Project, Assignment, Final Exam

Course Title	Steel Structures Design Lab	Course Code	CE 360	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of analysis of steel structures, e.g. truss, plate girder; design of members and joints of structures; use of software in analysis and design problems.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Analysis and design of truss and truss members (**PO1, PO2**)
CO 2: Analysis and design of plate girder (**PO1, PO2**)
CO 3: Use software to analyze and design structure. (**PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze and **design** truss and truss members	Introduction to truss, Dead load and live load calculation, design of truss member, design of joints	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Analyze and **design** plate girder	Design of girder	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Use software to analyze and design structure.	Use of design softwares	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva

Course Title	Concrete Structures	Course Code	CE 356	Credit Hour	1.5

	Design Lab I	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to analyze and design of Slab Bridge, simple girder bridge and a low rise building.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Analyze and design Slab Bridge. (PO1, PO2)
CO 2: Analyze and design simple girder bridge. (PO1, PO2)
CO 3: Analyze and design a low rise building. (PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze and **design** Slab Bridge.	Determination of slab thickness, slab design, reinforcement layout	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Analyze and **design** simple girder bridge.	Design of girder	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva
Analyze and **design** a low rise building.	Design of slab, design of beam, design of wall, and footing.	Class room instruction, Active learning, Multimedia demonstrations	Assignments/Group work, Class tests, Final Quiz, Viva

Course Title	Concrete Structures Design Lab II	Course Code	CE 452	Credit Hour	1.5

		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the analysis of buildings and PC girder bridges, design of multistoried RCC frame residential building and simple span PC girder bridge.				
Course Learning Outcomes (COs): Upon completion of the course, the students will be able to – CO 1: Apply modern concept of concrete design for civil engineering practices. **(PO5, PO3,PO12)** CO 2: Analyze and design a multistoried RCC frame residential building according to updated BNBC code. **(PO1, PO12)** CO 3: Analyze various components of PC girder bridges. **(PO1, PO3,PO12)** CO 4: Design simple span PC girder bridge. **(PO3, PO12)**					
Course Learning Outcomes (COs)	**Course Content**			**Teaching Learning Strategy**	**Assessment Strategy**
Apply modern concept of concrete design for civil engineering practices.	Introduction to modern technologies, techniques and practices of concrete structures.			Lecture	Assignment, Viva Final Exam
Analyze and **design** a multistoried RCC frame residential building according to updated BNBC code.	Calculate the gravity loads and lateral loads of a multistoried RCC frame residential building, design of building components.			Lecture	Assignment, Viva, Final Exam
Analyze various components of PC girder bridges.	Analysis of PC girder bridges			Lecture	Assignment, Viva, Final Exam
Design simple span PC girder bridge.	Design of simple span PC girder bridge			Lecture	Assignment, Viva, Final Exam

Environmental Engineering

Course Title	Water Supply Engineering	**Course Code**	CE 311	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of water supply engineering, ground water and surface water, water quality and water purification technologies.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain basic elements of water supply system. **(PO1, PO4)**

CO 2: Depict water quality of both surface and ground water. **(PO9, PO7)**

CO 3: Compare different water purification techniques. **(PO9, PO6)**

CO 4: Design water treatment units and water safety plans.**(PO3, PO6)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain basic elements of water supply system.	Introduction to water supply engineering: water demands, water supply sources, Surface water collection and transportation.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Depict water quality of both surface and ground water.	Water quality requirements.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compare different water purification techniques.	Water treatment - plain sedimentation, coagulation, flocculation, filtration, disinfection; miscellaneous treatment methods.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design water treatment units and water safety plans.	Low cost treatment methods for rural communities. Water safety plans.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Wastewater and Sanitation Engineering	Course Code	CE 313	Credit Hour	4.0
		Contact Hours/week	4.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of environmental sanitation and wastewater engineering such as —estimation of wastewater; wastewater collection systems; hydraulics of sewer; design, construction and maintenance of sanitary sewer and storm drainage system; sewer appurtenances; plumbing system; microbiology of wastewater; wastewater characteristics; wastewater treatment and disposal; treatment and disposal of industrial effluents; sludge treatment and disposal; sanitation and health; low cost sanitation technology; septic tank system and sustainability of water.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain sewage system, sewage hydraulics, pipe materials, waste collection system. (PO1, PO4)

CO 2: Depict microbiology of sewage and wastewater. (PO9, PO7)

CO 3: Compare chemical properties of industrial, domestic and storm sewage. (PO9, PO6)

CO 4: Design septic tank, activated sludge process and trickling filter as per Bangladesh standard. (PO3, PO6)

CO 5: Apply low cost techniques to provide sanitation for rural community. (PO2, PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain sewage system, sewage hydraulics, pipe materials, waste collection system.	Sewage system. Sewage hydraulics and pipe materials. Load on pipes, Design of waste water collection system. Appurtenances, plumbing systems.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Depict microbiology of sewage and wastewater.	Microbiology of sewage and waste water. Wastewater characteristics; preparatory, primary treatment methods. Secondary treatment methods and disposal.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compare chemical properties of industrial, domestic and storm sewage.	Storm water drainage system. Design of storm water collection system. Treatment and disposal of industrial effluents.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design septic tank, activated sludge process and trickling filter as per Bangladesh standard.	Design of septic tank system. Activated sludge process. Trickling filter design.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply low cost techniques to provide sanitation for rural community.	Sanitation for low income communities – on-site sanitation systems for rural communities. Low cost small bore sewerage for small townships. Rural sanitation in Bangladesh.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Environmental Engineering Lab I	Course Code	CE 314	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of water quality requirements, water and waste water sampling techniques, physical, chemical and biological tests of water and wastewater.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge about water sampling techniques. (PO1, PO4)
CO 2: Determine physical, chemical, biological properties of water. (PO4, PO6)
CO 3: Analyze solid waste for treatment and disposal. (PO3)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge about water sampling techniques.	Water quality requirements, water and waste water sampling techniques, sample preservation.	Lecture, Practical/ Experimental Demonstration	Assignments, Report, Viva, Final Quiz
Determine physical, chemical, biological properties of water.	Physical, chemical and biological tests of water and wastewater; breakpoint chlorination, alum coagulation.	Lecture, Practical/ Experimental Demonstration	Assignments, Report, Viva, Final Quiz
Analyze solid waste for treatment and disposal.	Sampling and laboratory analysis of solid waste.	Lecture, Practical/ Experimental Demonstration	Assignments, Report, Viva, Final Quiz

Geotechnical Engineering

Course Title	Principles of Soil Mechanics	**Course Code**	CE 321	**Credit Hour**	4.0
		Contact Hours/week	4.0	**Prerequisite**	CE 203
Synopsis	This course has been designed to discuss the major topics of Geotechnical Engineering such as—formation, type and identification of soils; soil composition; soil structure and fabric; index properties of soils; engineering classification of soils; soil compaction; principles of total and effective stresses; permeability and seepage; stress-strain-strength characteristics of soils; compressibility and settlement behavior of soils; lateral earth pressure; stress distribution.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Determine different types of soil and their composition including soil classification by USCS method. (**PO1**)

CO 2: Explain permeability, seepage, consolidation and shear strength behavior of soil. (**PO1, PO3**)

CO 3: Calculate total and effective stress, Mohr's circle and stress due to surface load. (**PO1, PO2**)

CO 4: Calculate lateral earth pressure using Rankine's method, Culmann's graphical method. (**PO2**)

CO 5: Evaluate slope stability using modified Bishop's method and ordinary method of slice. (**PO3, PO2**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine different types of soil and their composition including soil classification by USCS method.	Introduction to geotechnical engineering, Formation, type and identification of soils, Soil composition; soil structure and fabric	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Explain permeability, seepage, consolidation and shear strength behavior of soil.	Permeability of soil, field permeability tests, California bearing ratio, field compaction and equipment, Soil compaction, compaction force, compaction behavior of sand	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Calculate total and effective stress, Mohr's circle and stress due to surface load	Principles of total and effective stresses, stress at a point, Mohr's circle, geostatic stress, stress due to surface load	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Calculate lateral earth pressure using Rankine's method, Culmann's graphical method	Lateral earth pressure, earth pressure at rest, Rankine's earth pressure theory, Culmann's graphical method.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Evaluate slope stability using modified Bishop's method and ordinary method of slice	Slope stability, causes of slope failure, Slope protection measures	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam

Course Title	Foundation Engineering	Course Code	CE 323	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of sub-soil investigation techniques; geotechnical aspects of building foundations; bearing capacity of shallow and deep foundations; settlement and distortion of foundations; design and construction of footings, rafts and piles. This course also covers the slope stability analyses of natural and man-made earth slope.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Comprehend and utilize the geotechnical literature to establish the frame work for foundation design. (PO1, PO2)

CO 2: Implement the site investigation program. (PO1, PO2)

CO 3: Evaluate the soil- structure behavior by obtaining necessary design parameters. (PO2)

CO 4: Design a shallow foundation for a structure. (PO3)

CO 5: Evaluate the earth slope stability. (PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Comprehend and **utilize** the geotechnical literature to establish the frame work for foundation design.	Geotechnical aspects of building foundations.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Implement the site investigation program.	Sub-soil investigation techniques.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Evaluate the soil- structure behavior by obtaining necessary design parameters	Techniques of Analysis and interpretation of sub-soil investigation information.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Design a shallow foundation for a structure.	Shallow foundation: pad footing, combined footing, strap footing and raft/mat foundation.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Evaluate the factors considered in deep foundation design	Deep foundation: pile, pier and caisson etc.	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam

Course Title	Geotechnical Engineering Lab I	Course Code	CE 324	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of 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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain various types of geotechnical engineering test. (**PO1, PO4**)

CO 2: Develop knowledge on the behavior of various types of soil. (**PO9, PO7**)

CO 3: Compare soil properties of fine grained and coarse grained soil. (**PO9, PO6**)

CO 4: Design various types of soil related diagram. (**PO3, PO6**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain various types of geotechnical engineering test.	Principle topics of field identification tests.	Lecture, Hand/Multimedia Demonstration	Class Tests, Quiz, Final Exam
Develop knowledge on the behavior of various types of soil.	Grain size analysis by sieve and hydrometer.	Lecture, Hand/Multimedia Demonstration	Class Tests, Quiz, Final Exam
Compare soil properties of fine grained and coarse grained soil.	Minimum water content for LL, PL and stress-strain-strength characteristics of soil.	Lecture, Hand/Multimedia Demonstration	Class Tests, Quiz, Final Exam
Design various types of soil related diagram.	Design of soil system by compaction test, relative density test, direct shear tests, consolidation tests.	Lecture, Hand/Multimedia Demonstration	Class Tests, Quiz, Final Exam

Transportation Engineering

Course Title	Transportation Planning and Traffic Engineering	Course Code	CE 331	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss, 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. Transportation in Bangladesh: transportation modes and networks, transport demand and modal share, road classification and design standards.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: **Illustrate** various methods to calculate the trip distribution number of highway. **(PO1, PO2, PO7)**

CO 2: **Calculate** super elevation, horizontal curve, vertical curve etc. of highway. **(PO2)**

CO 3: **Discuss** the factors influencing road vehicle performance characteristics and design. **(PO3)**

CO 4: **Design** the highway lighting system and traffic signaling for various conditions. **(PO3)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Illustrate various methods to calculate the trip distribution number of highway.	Elements of Transportation System and Trip Distribution	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Calculate super elevation, horizontal curve, vertical curve etc. of highway.	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	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Discuss the factors influencing road vehicle performance characteristics and design.	Traffic Control Devices and O-D study. 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;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design the highway lighting system and signal design for various conditions.	Street Lighting Design and Traffic Signal Design	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Pavement Design and Railway Engineering	Course Code	CE 333	Credit Hour	4.0
		Contact Hours/week	4.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Transportation Engineering such as— Railways: general requirements, alignment, permanent way, station and yards, signaling, points and crossings, maintenance Highway materials; subgrade, subbase 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				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain various components of railways (**PO1**)

CO 2: Apply different techniques for maintenance of flexible and rigid pavements (**PO1**, **PO3**)

CO 3: Calculate super elevation, horizontal curve, vertical curve and resistance of railway track.(**PO3, PO2**)

CO 4: Calculate mix proportion of aggregate and bitumen.(**PO2**)

CO 5: Design flexible and rigid pavement using AASHTO, CBR, IRC, RHD methods. (**PO2**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain various components of railways	Introduction to Railway Engineering, Gauges and Permanent Way, sleeper, ballast, subgrade, fastening, switch, crossing, signaling and wears and failures in Rails.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply different techniques for maintenance of flexible and rigid pavements	Flexible pavements - specification of materials, construction method and field control checks for various types of flexible pavements. Rigid pavements - specification and method of construction, construction of various types of joints	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Calculate super elevation, horizontal curve, vertical curve and resistance of railway track.	Fastenings, Geometric Design - Alignment of Track, Horizontal Curve &, Super elevation, Speeds on Track, Transition Curve, Vertical Curve & Gradients	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Calculate mix proportion of aggregate and bitumen	Marshall mix design, standards, characteristics curves, test related problems, Hveem mix design	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design flexible and rigid pavement using AASHTO, CBR, IRC, RHD methods.	CBR method, principle, advantages and application, testing as per BS, AASHTO, and asphalt institute, problems on above. AASHTO design chart, design of longitudinal, contraction and expansion joints, and design of slabs.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Transportation Engineering Lab I	Course Code	CE 334	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Transportation Engineering such as— Tests of coarse aggregates used as road base and sub base materials, Tests of bituminous materials, tests on subgrade, sub-base and base materials; bituminous mix design; roadway capacity analysis; application of analytical, simulation and statistical packages.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Determine different physical properties of coarse aggregates as per British Standard (BS) (**PO4**)
CO 2: Explain various physical properties of bituminous materials (**PO4, PO5**)
CO 3: Calculate shape and size properties of coarse aggregates as per BS standard. (**PO4, PO2**)
CO 4: Apply different field techniques to count traffic volume and capacity of signalized intersection. (**PO5**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine different physical properties of coarse aggregates as per British Standard (BS)	Tests on aggregate impact value, aggregate crushing value, ten percent fines value.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain various physical properties of bituminous materials	Laboratory tests on specific gravity, solubility, flash and fire point, ductility, penetration value as per ASTM and AASHTO standard for road construction	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Calculate shape and size properties of coarse aggregates as per BS standard.	Tests on flakiness index, elongation index and angularity number	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply different field techniques to count traffic volume and capacity of signalized intersection	Manual and video camera methods to count traffic volume and capacity of signalized intersection using HCM 1994 and Road note 34 method	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Water Resources Engineering

Course Title	Open Channel Flow	**Course Code**	CE 341	**Credit Hour**	4.0
		Contact Hours/week	4.0	**Prerequisite**	CE 241
Synopsis	Open channel flow and its classification; velocity and pressure distributions; energy equation, specific energy and transition problems; critical flow and control; principles of flow measurement and devices; concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow; momentum equation and specific momentum; hydraulic jump theory and analysis of gradually varied flow.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Solve open channel flow problems through the selection and application of proper equations.(PO2)

CO 2: Explain physical characteristics of hydraulic jumps surges and critical, uniform and gradually varied flow.(PO1)

CO 3: Apply mathematical relationships for hydraulic jumps, surges and critical, uniform and gradually varied flows.(PO3)

CO 4: Design open channel by determining their cross sections.(PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Solve open channel flow problems through the selection and application of proper equations.	Introduction to Open Channel Flow, Kinds of Open Channel, Types of Open Channel ,Flow Problems solve /calculation, Computation of Critical Depth, Analytical method, Trial and Error Method, Numerical Methods, Uniform Flow (Establishment of Uniform Flow, Uniform flow formulas & Computation)	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain physical characteristics of hydraulic jumps surges and critical, uniform and gradually varied flow	Continuity, Energy & Momentum Equation, Specific energy and specific energy curve, Effects of Viscosity and Gravity Velocity distribution in open channel flow, Velocity distribution coefficients, Hydrostatic pressure distribution, Pressure distribution in curvilinear flow	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply mathematical relationships for hydraulic jumps, surges and critical, uniform and gradually varied flows.	Channel Section with Composite roughness, Compound cross-section, Computation of flood Discharge. Hydraulic Jump (Definition, Types of Jump, Problem)	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design open channel by determining their cross sections.	Problems, Stilling Basin, Channel Design (Introduction, Alluvial Channel: Regime Approach).	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Hydrology, Irrigation Engineering and Flood Management	**Course Code**	CE 345	**Credit Hour**	3.0
		Contact Hours/week	3.0	**Prerequisite**	N/A
Synopsis	Hydrologic cycle; hydrologic measurement: precipitation, evaporation and stream flow; hydrographs; plant-soil-water relationship; consumptive use and estimation of irrigation water requirements; methods of irrigation; quality of irrigation water; problems of irrigated land; flood and its management.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop knowledge about various components of hydrologic cycle that affect the movement of water in the earth.(PO1)

CO 2: Illustrate various Stream flow measurements technique (PO1)

CO 3: Develop knowledge about the basic requirements of irrigation and various irrigation techniques, requirements of the crops. (PO1)

CO 4: Design distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design. (PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge about various components of hydrologic cycle that affects the movement of water in the earth.	Hydrological cycle, precipitation, mean rainfall over a drainage Basin. Evaporation, transpiration, infiltration, overland flow, measurement of infiltration.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Illustrate various Stream flow measurements technique.	Stream flow measurements, direct measurements, measurement of stage, Dilution technique. Hydrograph, Flood, determination of discharge (probability method).	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge about the basic requirements of irrigation and various irrigation techniques, requirements of the crops.	Water requirements of crops, Irrigation requirements, duty and delta, Irrigation efficiencies. Design of conventional and modern methods of irrigation, Irrigation of arid lands.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design.	Distribution systems for canal irrigation, canal capacity, canal losses, alignment of canals. Alluvial and Non alluvial canals, design of alluvial channels, laceys theory, Design of Non- alluvial channels, design of lined canals. Sediment transport: regime theory, drainage system.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Open Channel Flow Lab	Course Code	CE 342	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	Broad crested weir, Sluice gate, Venturi flume, Parshal flume, Cut-Throat flume, Hydraulic Jump, Velocity distribution profile, Manning's roughness coefficient, Specific force and Specific energy.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Determine the state of flow in open channel. (PO4)

CO 2: Measure open channel discharge by using different flow measuring devices. (PO5)

CO 3: Observe Hydraulic jump and develop relationship among different parameters of jump. (PO4)

CO 4: Develop generalized specific energy and specific force curve. (PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine the state of flow in open channel.	Determination of State of Flow in Open Channel.	Lecture, Hand Demonstration, Practical Exercise.	Assignment, Viva, Quizzes
Measure open channel discharge by using different flow measuring devices.	Flow through a Venture Flume, Broad crested weir, Parshall Flume, Sluice Gate, etc.	Lecture, Hand Demonstration, Practical Exercise.	Assignment, Viva, Quizzes
Observe Hydraulic jump and develop relationship among different parameters of jump.	Create a hydraulic jump in a horizontal rectangular channel and development of different relationship between heights, length, and efficiency energy loss of a jump.	Lecture, Hand Demonstration, Practical Exercise.	Assignment, Viva, Quizzes
Develop generalized specific energy and specific force curve.	Development of Generalized Specific Energy And Specific Force Curves.	Lecture, Hand Demonstration, Practical Exercise.	Assignment, Viva, Quizzes

Civil Engineering Practices

Course Title	Project Planning and Construction Management	Course Code	CE 491	Credit Hour	3.0
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of project management, construction safety, project evaluation, project planning and scheduling. Project planning and evaluation; feasibility reports; cash flows, payback period, internal rate of return; benefit-cost ratio; cost-benefit analysis case studies; Planning and scheduling, PERT, CPM; resource scheduling; linear programming and application, Principles of management; construction management: management of materials and equipment, site management, contracts and specifications, inspection and quality control, safety, economy. Conflict management; human resource management. Demand forecasting; inventory control; stores management; procurement; legal issues in construction; environmental regulations.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Explain the fundamental project management, organization, authority. (PO3)
CO 2: Depict project cost, annual rate of return, benefit. (PO9, PO7, PO12)
CO 3: Compare and evaluate the project. (PO9)
CO 4: Design of construction safety module. (PO3, PO8)
CO 5: Apply linear programming in product design. (PO3)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain the fundamental project management, organization, authority.	Principles of management; construction management: principles, project organization, methods and practices, technology, management of materials and equipment,	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Depict project cost, annual rate of return, benefit.	Project planning and evaluation; feasibility reports; cash flows, payback period, internal rate of return; benefit-cost ratio; cost-benefit analysis case studies	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compare and evaluate the project.	Planning and scheduling, PERT, CPM; resource scheduling	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design of construction safety module.	Contracts and specifications, inspection and quality control, safety, economy. Conflict management; psychology in administration: human factors in management; human resource management. Demand forecasting; inventory control; stores management; procurement; legal issues in construction;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply linear programming in product design.	Resource scheduling; linear programming and application	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Professional Practices,	Course Code	CE 493	Credit Hour	3.0

	Communication and Ethics	**Contact Hours/week**	3.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss Project, its characteristic feature, project life cycle; type of contracts; procurement regulations and law; documents for procurement of works, goods and services and their application; contract risk and contract responsibility; insurances; tender procedure; claims, disputes and arbitration procedure; measures for reducing fiduciary risks. Introduction to communication concepts, modes of communication, methods of effective communication; writing reports; oral presentation of reports; writing proposals; preparing effective business messages; conducting meetings; strategies for effective speaking and successful inter personal communication; job application process, interviews and follow-ups. Introduction to the code of ethics for Professionals and Legislation for Professionals.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: **Explain** various components of projects and project management. (**PO1, PO10**)
CO 2: **Apply** different techniques for maintenance of a successful project. (**PO3, PO2**)
CO 3: **Practice** the professional ethics in civil engineering job. (**PO7, PO5**)
CO 4: **Manage** the three parties of project successfully with performing their demands. (**PO9, PO2, PO10, PO6, PO5**)
CO 5: **Define** tender and tender system. (**PO1, PO10, PO7**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain various components of projects and project management.	Project, The project cycle and Project proposal	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply different techniques for maintenance of a successful project.	Contractual provisions and Specifications	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Practice the professional ethics in civil engineering job.	Professional ethics in engineering and ABET & BAETE.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Manage the three parties of project successfully with performing their demands.	Interpretation of literature, documents and Communicating	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Define tender and tender system.	Project management and Tender	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Professional Practices and Communication Sessional	Course Code	CE 494	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the application of communication theory and professional practice approaches in a controlled class room environment.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Communicate effectively in professional career. **(PO9, PO8, PO10, PO12)**
CO 2: Develop report writing skills. **(PO4, PO8, PO10)**
CO 3: Develop knowledge about different case study. **(PO9, PO10, PO12)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Communicate effectively in professional career.	Application of communication theory and professional practice approaches.	Lecture, Presentation	Assignments, Presentation, Viva, Final Quiz
Develop report writing skills.	Role playing, preparing small reports and proposals.	Lecture, Presentation, Report writing	Assignments, Presentation, Viva, Final Quiz
Develop knowledge about different case study.	Case study analysis, class room presentations and individual reports.	Lecture, Presentation, Case study	Assignments, Presentation, Viva, Final Quiz

Course	Socio – Economic Aspects of	Course Code	CE 495	Credit Hour	3.0

Title	Development Projects	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Socio – Economic Aspects of Development Projects such as — Economics and social structure; development and economic growth; socio-economic indicators; concept of human development, human development index; gender related human development index; human poverty and human poverty index; poverty reduction strategies in Bangladesh; concepts of sustainable development; MDGs. Characteristics of development projects; industries and other economic benefits; inequalities in distribution of benefits and losses; Socio-economic impact assessment approach; socio-economic survey; case studies.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop an understanding of the emerging concept of socio-economic aspect and sustainable development. (PO3, PO7)

CO 2: Identify need assessment process to determine the needs and problems regarding productivity, land loss, land use, fisheries and aquaculture, deforestation etc. in a community. (PO7, PO6)

CO 3: Evaluate the actual conditions on the basis of health & nutrition, inequalities in distribution of benefits and losses by different types of survey method. (PO3, PO7)

CO 4: Assess project results of a project by impact assessment approaches.(PO7, PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop an understanding of the emerging concept of socio-economic aspect and sustainable development.	Economics and social structure; development and economic growth;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Identify need assessment process to determine the needs and problems regarding productivity, land loss, land use, fisheries and aquaculture, deforestation etc. in a community.	Characteristics of development projects; human interest related aspects; population displacement; resettlement and rehabilitation strategy; Productivity; land loss, land use and land ownership patterns; fisheries and aquaculture; deforestation and a forestation;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Evaluate the actual conditions on the basis of health & nutrition, inequalities in distribution of benefits and losses by different types of survey method.	communication, commerce, industries and other economic benefits; water supply, sanitation, health and nutrition; inequalities in distribution of benefits and losses;	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Assess project results of a project by impact assessment approaches.	Socio-economic impact assessment approach; socio-economic survey; case studies.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course	Business and Career	Course Code	CE 498	Credit Hour	3.0

Title	Development	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss on techniques of effective communication, human resource management as well as different aspect of market management. 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, emPOyee 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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept effective communication, human resource management and market management. (PO9, PO8)

CO 2: Explain techniques of modern business letters, memos and reports. (PO10, PO12, PO6)

CO 3: Analyze different aspect of market management and human resource management. (PO6)

CO 4: Design and evaluate different market segment, appraisal procedures. (PO8, PO6)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept effective communication, human resource management and market management.	Introduction to effective communication. Techniques of effective communication in professional environment. introduction to operations management, basic production decisions of an organization	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain techniques of modern business letters, memos and reports.	Writing techniques of modern business letters, memos and reports.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Analyze different aspect of market management and human resource management.	Human resource management: source of manpower. Methods of selection and recruitment. Basic marketing management. control within operations process	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design and evaluate different market segment, appraisal procedures.	Development and motivating the workforce, appraisal procedures. Segmentation and market analysis. Marketing strategies and use of marketing tools. Branding, choosing brand elements, brand extension and its advantages and disadvantages.	Active learning, Multimedia Presentation, Practical example	Class Test, Assignment, Final Exam

Major + Minor Optional Courses
Structural Engineering

Course Title	Introduction to Finite Element Method	**Course Code**	CE 453	**Credit Hour**	2.0
		Contact Hours/week	2.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the basic concepts of Finite Element as well as computer application of its. Introduction to finite element method as applied to stress analysis problems; basic equations in elasticity, matrix displacement formulation, element shapes, nodes, nodal unknowns and coordinate system, shape functions, strain displacement matrix, methods for assembling stiffness equations e.g. direct approach, Galerkin's method, virtual work method, principle of minimum potential energy; introduction to isoparametric formulation; discritization of a structure and mesh refinement, one dimensional stress-deformation and two dimensional plane stress and plane strain analysis of stress deformation problems; numerical integration and computer application.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept of finite element method. (PO1)
CO 2: Compute basic equations in elasticity, element shapes, nodes, nodal unknowns. (PO1)
CO 3: Analyze the discritization of a structure and mesh refinement and plane strain analysis of stress deformation problems. (PO3)
CO 4: Design the structure using it by formulating equation and computer application. (PO1, PO3)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept of finite element method.	Introduction to finite element method as applied to stress analysis problems.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute basic equations in elasticity, element shapes, nodes, nodal unknowns.	Basic equations in elasticity. Matrix displacement formulation, element shapes, nodes, nodal unknowns and coordinate system.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze the discritization of a structure and mesh refinement and plane strain analysis of stress deformation problems.	Discritization of a structure and mesh refinement .Shape functions, strain displacement matrix. Methods for assembling stiffness equations e.g. Direct approach, galerkin's method. Virtual work method. Introduction to isoparametric formulation. One dimensional stress-deformation and two dimensional plane stress and plane strain analysis of stress deformation problems.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design the structure using it by formulating equation and computer application.	Numerical integration and computer application.	Active learning, Multimedia Presentation, Practical example	Class Test, Assignment, Final Exam

Course Title	Prestressed Concrete	Course Code	CE 455	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to provide students with a clear and thorough understanding about the major topics of prestrerssed concrete such as —concepts of prestressing; materials; anchorage systems; loss of prestress; analysis of sections for flexure, shear, bond and bearing; analysis of end block and composite sections; beam deflections; cable layout; partial prestress. This course also covers the Design of prestressed concrete beams for simple and continuous spans; ideas about use of AASHTO – PCI sections for standard spans; design considerations for prestressed concrete pipes, piles, poles and railway sleepers.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge about concept of prestressing and the behavior of concrete structures. **(PO1, PO3)**

CO 2: Determine losses of prestress in prestressed concrete structures. **(PO1, PO2)**

CO 3: Determine the deflection and camber of prestressed concrete members. **(PO1, PO2)**

CO 4: Apply the provisions of ACI 318 code to the design and detail of prestressed concrete structures for flexure, shear, bearing and torsion. **(PO1, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge about the concept of prestressing and the behavior of concrete structures.	concepts of prestressing; materials; anchorage systems;	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Determine losses of prestress in prestressed concrete structures	Loss of prestress: types and analysis methods	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Determine the deflection and camber of prestressed concrete members.	beam deflections; cable layout;	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam
Apply the provisions of ACI 318 code to the design of prestressed concrete structures for flexure, shear, bearing and torsion.	analysis of sections for flexure, shear, bond and bearing; analysis of end block and composite sections	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam

Course	Design of Concrete Structures	Course Code	CE 457	Credit Hour	2.0

Title	III	Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of 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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Analyze structures for torsion. **(PO1, PO2)**
CO 2: Design one way and two way joist slabs. **(PO3)**
CO 3: Examine lateral load resisting components of a structure. **(PO3)**
CO 4: Design different joints. **(PO3, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Analyze structures for torsion.	Introduction to concept of torsion. Saint-Venant Principle of torsion. Determination of shear stress due to torsion in different types of cross-sections. Determination of torsional rigidity. Design concept and Code provisions for designing structures for torsion, failure modes.	Lecture, Hand/Multimedia Demonstration	Assignment, Final Exam
Design one way and two way joist slabs.	Concepts of one way and two way slabs with or without beams on the column line. Design of such slabs for flexure, shear, check for deflection.	Lecture, Hand/Multimedia Demonstration	Class Test, Final Exam
Examine lateral load resisting components of a structure.	Importance of lateral load bearing elements. Design of lateral load resisting elements: shear wall, lift cores, diaphragm etc. Code provisions. Special design considerations.	Lecture, Hand/Multimedia Demonstration	Class Test, Assignment, Final Exam
Design different joints.	General idea of components of structural joints. Classifications of joints. Behavior of joints. Design and detailing of joints according to Code provisions. Repair techniques of joints.	Lecture, Hand/Multimedia Demonstration	Term paper/Presentation, Class Test, Final Exam

Course Title	Dynamics of Structures	Course Code	CE 459	Credit Hour	2.0

		Contact Hours/week	2.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of single degree of freedom system, formulation of equation of motion, free vibration response, response to harmonic, impulse and general dynamic loading, and vibration analysis by Rayleigh's method, response spectra, and two degrees of freedom system.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop knowledge on one and two degree of freedom systems. (**PO1**)

CO 2: Formulate equation of motion. (**PO1, PO3**)

CO 3: Analyze structural vibration. (**PO3, PO2**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on one and two degree of freedom systems.	Single degree of freedom system, two degrees of freedom system.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam
Formulate equation of motion.	Formulation of equation of motion.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam
Analyze structural vibration.	Free vibration response, response to harmonic, impulse and general dynamic loading, and vibration analysis by Rayleigh's method, response spectra.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam

Course	Introduction to Steel Concrete	**Course Code**	CE 461	**Credit Hour**	2.0

Title	Composite Structures	Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the basic concepts of steel concrete composite structures as well as design of composite column and floor system. 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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept of steel concrete composite structures and their advantages.. (**PO1**)

CO 2: Compute axial load capacity and interaction diagrams for composite columns.(**PO3, PO2**)

CO 3: Analyze composite beams and beam-column connections.(**PO3, PO2**)

CO 4: Design composite beams and beam-column connections. (**PO3, PO2**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept of steel concrete composite structures and their advantages.	Introduction to composite structures. Advantages of composite construction. Interaction between steel and concrete. Shear connectors	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute axial load capacity and interaction diagrams for composite columns.	Axial load capacity and interaction diagrams for composite columns.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze composite beams and beam-column connections.	Elastic analysis of composite beams. Beam-column connections. Behavior of different types of composite columns	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design composite beams and beam-column connections.	Beam-column connections. Behavior of different types of composite columns.	Active learning, Multimedia Presentation, Practical example	Class Test, Assignment, Final Exam

Course	Computer Aided Analysis and	Course Code	CE 454	Credit Hour	1.5

Title	Design Sessional	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to perform software-based analysis and design of various reinforced concrete structures and steel structures according to different building codes.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Generate software model for various RCC and steel structure. **(PO2)**
CO 2: Assess the performance of an existing reinforced concrete building and steel structure according to BNBC and other building codes.**(PO2, PO5)**
CO 3: Design the reinforced concrete buildings and steel structures according to BNBC, ACI and related building codes. (**PO12, PO5**)
CO 4: Revise an existing structure. **(PO2, PO12, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Generate software model for various RCC and steel structure.	Software-based modeling of various reinforced concrete structures and steel structures according to different building codes.	Lecture, Multimedia & Software Demonstration	Assignments, Lab Report, Class Performance Final Quiz, Viva
Assess the performance of an existing reinforced concrete building and steel structure according to BNBC and other building codes.	Software-based performance analysis of various reinforced concrete structures and steel structures according to different building codes.	Lecture, Multimedia & Software Demonstration	Assignments, Lab Report, Class Performance Final Quiz, Viva
Design the reinforced concrete buildings and steel structures according to BNBC, ACI and related building codes.	Software-based analysis and design of various reinforced concrete structures and steel structures according to different building codes.	Lecture, Multimedia & Software Demonstration	Assignments, Lab Report, Class Performance Final Quiz, Viva
Revise an existing structure.	Software-based analysis of Existing structural components.	Lecture, Multimedia & Software Demonstration	Assignments, Lab Report, Class Performance Final Quiz, Viva

Environmental Engineering

Course Title	Solid and Hazardous Waste Management	Course Code	CE 411	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of solid and hazardous waste management.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Differentiate between solid waste and hazardous waste. (PO1, PO4)
CO 2: Explain properties of solid waste and its management process. (PO1, PO6)
CO 3: Develop fundamental knowledge about hospital waste and its treatment and disposal. (PO1, PO7)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Differentiate between solid waste and hazardous waste.	Solid Waste Management: sources and types of solid wastes. Hazardous Waste Management: identification, sources and characteristics of hazardous wastes.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain properties of solid waste and its management process.	Physical and chemical properties of solid wastes, solid waste generation, onsite handling, storage and processing, collection of solid wastes, transfer stations and transport, ultimate disposal methods, resources and energy recovery and recycling, soil pollution, industrial solid waste collection and disposal.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop fundamental knowledge about hazardous waste and its treatment and disposal.	Hospital waste management practices, legal aspects, auditing and prevention, methods of treatment and disposal – physical, chemical, biological and thermal treatment, stabilization and solidification, engineering storage, incineration, landfill and deep burial.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Environmental Pollution Management	Course Code	CE 413	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of water pollution and air pollution.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Explain sources of water pollution and its control. (PO1, PO8)
CO 2: Develop fundamental knowledge about air pollution and its effect on health. (PO1, PO6)
CO 3: Indentify causes and effects of water and air pollution. (PO7)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain sources of water pollution and its control.	Water pollution: sources and types of pollutants, waste assimilation capacity of streams, dissolved oxygen modeling, ecological balance of streams, industrial pollution, heavy metal contamination, detergent pollution and eutrophication, groundwater pollution, marine pollution, pollution control measures: water quality monitoring and management.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop fundamental knowledge about air pollution and its effect on health.	Air pollution: sources and types of pollutants, effects of various pollutants on human health, materials and plants, air pollution meteorology.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Indentify causes and effects of water and air pollution.	Global warming, climate change and ozone layer depletion, acid rain, air pollution monitoring and control measures, introduction to air quality models.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Environmental and Sustainable Management	Course Code	CE 415	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of environment and sustainable development.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Explain environment and sustainable development. (PO1, PO8)
CO 2: Develop fundamental knowledge about environmental impact assessment of development. (PO1, PO6)
CO 3: Identify issues of economics of environmental management. (PO7)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain environment and sustainable development.	Environment and development projects, environment and sustainable development, environmental policies and legislation, environmental implication of sectorial development.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop fundamental knowledge about environmental impact assessment of development.	Environmental quality standards, environmental issues and priorities, environmental impact assessment of development schemes-baseline studies, assessment methodologies.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Identify issues of economics of environmental management.	Economics of environmental management, contemporary issues; case studies.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Environmental Engineering Lab II	Course Code	CE 414	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of the design of water supply and sewerage system.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Calculate water demands of an industrial area. (PO2)

CO 2: Design water and wastewater network. (PO3)

CO 3: Apply knowledge of water treatment techniques in the field. (PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Calculate water demands of an industrial area.	Design of water supply and sewerage system: estimation of industrial, domestic and fire demands, designing deep tube well and water distribution network, estimation of industrial, domestic and commercial wastewater generation.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz
Design water and wastewater network.	Wastewater network design, household plumbing system design, design of water and wastewater treatment plant.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz
Apply knowledge of water treatment techniques in the field.	Computer application in environmental engineering, field visits and reporting.	Lecture, Calculation, Handouts	Assignments, Report, Viva, Final Quiz

Geotechnical Engineering

Course Title	Earth Retaining Structures	Course Code	CE 421	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to design earth retaining structures such as dam, embankment, retaining wall, sheet piles etc. and construction methods also. Foundation of structures subjected to lateral loads; rigid and flexible earth retaining structures; methods of construction: dewatering and slurry-wall construction, braced excavation, sheet piles, cofferdams, caissons.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept of lateral loads exerted by soil. (PO1)

CO 2: Compute the soil parameters and loads on earth retaining structures. (PO3, PO2)

CO 3: Analyze the different types of earth retaining structures and their applications.(PO3, PO2)

CO 4: Design the different types of earth retaining structures. (PO3, PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept of lateral loads exerted by soil.	Foundation of structures subjected to lateral loads	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute the soil parameters and loads on earth retaining structures.	Rigid and flexible earth retaining structures	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze the different types of earth retaining structures and their applications.	Methods of construction. Dewatering and slurry-wall construction. Braced excavation, sheet piles, cofferdams, and caisson.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design the different types of earth retaining structures.	Braced excavation, sheet piles, cofferdams, and caisson.	Active learning, Multimedia Presentation, Practical example	Class Test, Assignment, Final Exam

Course Title	Soil Water interaction	Course Code	CE 425	Credits	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of soil-water interaction issues such as permeability, capillarity and soil suction. This is followed by the analysis of slopes subjected to water current, wave action etc. This course also covers the theories of filters and revetment design. Finally, different geotechnical aspects of landfills design are introduced to provide students a good understanding.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –

CO 1: Identify water related problems on earthen structures and foundation soil. **(PO1)**

CO 2: Analyze the stability of earth slope subjected to water current and water wave. **(PO1, PO2)**

CO 3: Design earth slope protection system and also can design revetment and filter (the granular and textile filter). **(PO3, PO2)**

CO 4: Explain landfills and can design landfills (geotechnical part). **(PO3, PO2)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Identify water related problems on earthen structures and foundation soil.	Introduction to soil- water interaction, permeability, capillarity and soil suction.	Classroom instruction, Active learning, Practical example.	Class Tests, Assignment, Final Exam
Analyze the stability of earth slope subjected to water current and water wave.	Earth slopes subjected to water current, wave action etc	Classroom instruction, Active learning, Practical example.	Class Tests, Assignment, Final Exam
Design earth slope protection system and also can design revetment and filter (the granular and textile filter).	Theories of filters and revetment design, design of revetment components.	Classroom instruction, Active learning, Practical example.	Class Tests, Assignment, Final Exam
Explain landfills and can design landfills (geotechnical part).	Geotechnical design of landfills.	Classroom instruction, Active learning, Practical example.	Class Tests, Assignment, Final Exam

Course Title	Elementary Soil	Course Code	CE 423	Credit Hour	2.0

	Dynamics	**Contact Hours/week**	2.0	**Prerequisite**	N/A
Synopsis	This course has been designed to discuss the major topics of elementary vibrations; dynamic properties of soil, seismic response of soils, site effects, site amplification, liquefaction problems, remedial measures and earthquake hazards.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Explain dynamic properties of soil. (**PO1**)
CO 2: Depict seismic response of soils. (**PO1, PO3**)
CO 3: Calculate liquefaction problems. (**PO3, PO2**)
CO 4: Develop knowledge of earthquake hazards.(**PO1**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain dynamic properties of soil.	Elementary vibrations, dynamic properties of soil.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Depict seismic response of soils.	Seismic response of soils: site effects, site amplification.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Calculate liquefaction problems.	Liquefaction problems, remedial measures.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam
Develop knowledge of earthquake hazards.	Earthquake hazards.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course	Geotechnical Earthquake	**Course Code**	CE 427	**Credit Hour**	2.0

Title	Engineering	Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of cyclic response of soils, local site effects, wave propagation through soil, site response analysis, liquefaction and post liquefaction behavior; seismic hazard analysis, seismic soil-structure interaction of foundations.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge cyclic response of soils. (**PO1**)
CO 2: Explain liquefaction behavior of soil. (**PO3, PO6**)
CO 3: Analyze seismic hazards. (**PO1, PO2, PO6**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge cyclic response of soils.	Cyclic response of soils, local site effects, wave propagation through soil, site response analysis.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain liquefaction behavior of soil.	Liquefaction and post liquefaction behavior of soil.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze seismic hazards.	Seismic hazard analysis, seismic soil-structure interaction of foundations.	Lecture, Hand Calculation	Class Tests, Assignment, Final Exam

Course Title	Geotechnical Engineering Lab-	Course Code	CE 424	Credits	1.5

	II	Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This subject is intended to provide students with a clear and thorough understanding of how to design building foundations (footing, pile and pile cap, pier, raft/mat foundations and caisson) with modern computer tools. This course also covers the major topics of Computer aided design of retaining structures (shore pile, abutment and retaining walls) and reinforced soils. This course provides the participants with an opportunity to apply the design procedures to a "real life" challenging foundation design projects.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Comprehend and utilize the geotechnical literature to establish the frame work for foundation design. (PO2, PO12)
CO 2: Assess site specific contextual factors and constraints to select appropriate geotechnical solutions to complex problems. (PO2, PO5)
CO 3: Analyze the role of a geotechnical engineer in civil engineering projects. (PO12, PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Comprehend and **utilize** the geotechnical literature to establish the frame work for foundation design.	Interpretation Design Data and soil data of building foundations using foundation engineering theories.	Classroom instruction by Hand/Multimedia Demonstration, Active learning, Practical design work.	Class performance grading, Assignment, Final Exam
Assess site specific contextual factors and constraints to select appropriate geotechnical solutions to complex problems.	Design work of building foundations and retaining structure using computer tools.	Classroom instruction by Hand/Multimedia Demonstration, Active learning, Practical design work.	Project report evaluation, Final Exam
Analyze the role of a geotechnical engineer in civil engineering projects.	Detailing of design work and the role of a geotechnical engineer in civil engineering projects.	Classroom instruction by Hand/Multimedia Demonstration, Active learning, Practical design work.	Assignment, Final Exam

Transportation Engineering

Course Title	Traffic Planning and Management	Course Code	CE 431	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	CE331, CE 333
Synopsis	This course has been designed to discuss the major topics of Transportation Engineering such as—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.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Determine transportation planning framework and basic principles (**PO1**)

CO 2: Explain transportation planning phases and transport demand analysis (**PO1, PO2**)

CO 3: Design sustainable strategies for pedestrian and bicycle facilities. (**PO3, PO7**)

CO 4: Apply different road safety techniques suitable for Bangladesh to mitigate road accidents. (**PO7**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine transportation planning framework and basic principles	Transportation Planning Process: Framework, Basic Principles of Transportation Planning	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Explain transportation planning phases and transport demand analysis	Transportation Planning Process: Phases and Analysis, Data Collection for Transportation Projects, Transportation Demand Analysis	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design sustainable strategies for pedestrian and bicycle facilities.	Design of Pedestrian Facilities, Bicycle Facilities, Design and Planning of Urban Bypass	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply different road safety techniques suitable for Bangladesh to mitigate road accidents.	Factors affecting Traffic Accident , Development of Accident Countermeasures, Hazardous Road Locations, Systematic Accident Investigation, Road Safety Engineering Strategies	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course		Course Code	CE 433	Credit Hour	2.0

Title	Pavement Management, Drainage and Airport	Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of transportation and traffic engineering such as (I) Study of pavement management system, design highway drainage system and different components of airport pavement and its design methodology. Pavement management systems; evaluation and strengthening of pavements; drainage: highway drainage and drainage structures; airports: importance, advantages and trends in air transportation, planning and design of airports, aircraft characteristics related to airport design, types and elements of airport planning studies, airport configuration, geometric design of the landing area, terminal area, heliports, design of airport pavements, lighting, marking and signing, airport drainage.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Develop knowledge on the fundamental concept of airport system and highway management.(**PO1**)

CO 2: Compute volume and highway distress level.(**PO1, PO2**)

CO 3: Analyze different technologies to provide treatment for highway distress and properly manage. (**PO3, PO2**)

CO 4: Design of airport runway system and highway drainage structures.(**PO2**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge on the fundamental concept of airport system and highway management.	Introduction to Pavement management systems. Evaluation of highway pavement and different methodology and their using. Introduction to airport and air traffic system.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Compute volume and highway distress level.	Strengthening of highway pavements and repairing techniques.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze different technologies to provide treatment for highway distress and properly manage.	Strengthening of highway pavements and repairing techniques. highway drainage and drainage structures	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Design of airport runway system and highway drainage structures.	Importance, advantages and trends in air transportation. Planning and design of airports. Aircraft characteristics related to airport design. Airport configuration, geometric design of the landing area, terminal area, heliports. Design of airport pavements, lighting, marking and signing, airport drainage	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Urban Transportation Planning and Management	Course Code	CE 435	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the topics of Transportation Engineering such as—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.				

Course Learning Outcomes (COs): Upon successful completion of the course, the students will be able to –
CO 1: Explain characteristics of urban transport, paratransit modes. (**PO1**)
CO 2: Determine causes and remedies of urban congestion. (**PO3, PO2**)
CO 3: Evaluate cost benefit of transportation projects (**PO3, PO2**)
CO 4: Explain sustainable transportation system and environmental issues (**PO1, PO6**)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Explain characteristics of urban transport, paratransit modes.	Introduction to urban transport problems and trends; road network planning	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Determine causes and remedies of urban congestion.	Congestion management; safety management, selected transport case studies	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Evaluate cost benefit of transportation projects	Planning transit network; estimating system costs and benefits, pricing and financing, evaluation, transit users attitude, policies and strategies for transit development in metropolitan cities	Classroom instruction, Active learning	Class Tests, Assignment, Final Exam
Explain sustainable transportation system and environmental issues	Transit users' attitude, policies and strategies for transit development in metropolitan cities; environmental issues and sustainable transport.	Classroom instruction, Active learning, Practical example	Class Tests, Assignment, Final Exam

Course Title	Transportation Engineering Lab II	Course Code	CE 434	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of Transportation Engineering such as—Design of rigid and flexible highway and air field pavements; geometric design: road intersections and interchanges; capacity calculations; traffic studies and design.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Determine spot mean speed and time mean speed from field survey data **(PO2)**

CO 2: Design of airport pavement using AC 150/5320-6E. **(PO5)**

CO 3: Calculate traffic volume by manual and video survey method. **(PO2)**

CO 4: Design of flexible pavement using RHD method and rigid pavement using PCA method. **(PO5)**

CO 5: Apply field data obtained from traffic survey to plan a signalized intersection and traffic control project.**(PO12, PO5)**

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Determine spot mean speed and time mean speed from field survey data	Speed Studies - Spot Speed Studies (Time-Mean Speed), Speed Studies – Space-Mean Speed	Lecture, Multimedia, Hand Note & Reference Books	Assignments, Lab Report, Final Quiz, Viva
Design of airport pavement using AC 150/5320-6E.	Airfield pavement design using FAA, AC-150	Lecture, Multimedia Lab Manual & Reference Books	Assignments, Lab Report, Final Quiz, Viva
Calculate traffic volume by manual and video survey method	Traffic Volume - Vehicle Classification Studies – Manual, Traffic Volume Studies – Intersections Manually	Lecture, Multimedia, Hand Note & Reference Books	Assignments, Lab Report, Final Quiz, Viva
Design of flexible pavement using RHD method and rigid pavement using PCA method.	Highway pavement design, Parking Study.	Lecture, Multimedia Lab Manual & Reference Books	Assignments, Lab Report, Final Quiz, Viva
Apply field data obtained from traffic survey to plan a signalized intersection and traffic control project.	Traffic Volume Studies – Intersections Manually, Pedestrian Volume Count Study, Intersection Delay Study, Intersection Design and Control Project	Lecture, Multimedia, Hand Note & Reference Books	Assignments, Lab Report, Final Quiz, Viva

Water Resources Engineering

Course Title	Ground Water Engineering	**Course Code**	CE 443	**Credit Hour**	2.0
		Contact Hours/week	2.0	**Prerequisite**	N/A
Synopsis	Physical properties of groundwater and aquifers, principles and fundamental equations of porous media flow and mass transport, well hydraulics and pumping test analysis, role of groundwater in the hydrologic cycle, groundwater quality and contamination.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Be Familiar with the terminology associated with Ground Water Engineering. (PO1)

CO 2: Develop knowledge about the porous medium properties that control groundwater flow and transport. (PO1, PO2)

CO 3: Apply groundwater flow equations to confined and unconfined aquifers. (PO3)

CO 4: Develop knowledge about the hydraulics of different kinds of wells. (PO3, PO2)

CO 5: Evaluate Quality of Ground Water. (PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Be Familiar with the terminology associated with Ground Water Engineering.	Origin and age of Groundwater, Rock properties affecting Groundwater, Zone of Aeration and Saturation, Types of Aquifers, Storage coefficient, Groundwater Basins, Springs.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge about the porous medium properties that control groundwater flow and transport.	Darcy's Law, Permeability, Hydraulic Conductivity, Compressibility, Groundwater Flow rates and direction.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Apply groundwater flow equations to confined and unconfined aquifers.	Principles and fundamental equations of porous media flow and mass transport.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge about the hydraulics of different kinds of wells	Steady Unidirectional flow, Steady Radial flow to a well, Test holes and well logs, Methods of constructing Shallow wells and Deep Wells.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Evaluate Quality of Ground Water	Role of Groundwater in the hydrologic cycle, Sources of salinity, Measures of water quality, Chemical and Physical Analysis,	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	River Engineering	Course Code	CE 445	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	Behavior of alluvial rivers; river channel pattern and fluvial processes; aggradations and degradation, local scours, river training and bank protection works; navigation and dredging sediment movement in river channels, bed form and flow regimes.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Develop knowledge about river dynamics and engineering (PO1)
CO 2: Develop creative river engineering design skills (PO3)
CO 3: Formulate river engineering related problems (PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Develop knowledge about river dynamics and engineering	Scope of River Engineering ;Classification and use of rivers ; Hydraulic characteristics of alluvial rivers; Classification of river flow	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop creative river engineering design skills	Hydrologic routing; Reservoir routing (Euler and Runge-Kutta methods); Channel Routing	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Formulate river engineering related problems	Fundamental aspects of sediment transport; Morphological characteristics of rivers. River stabilization/improvement ; Bank and bed protection facilities	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Hydraulic Structure	Course Code	CE 447	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	Principles of design hydraulic structures, types of hydraulic structures; design of dams, barrages, weirs, spillways, energy dissipaters and spillway gates; cross drainage works.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –
CO 1: Define basic theories of hydraulic structure design concepts- dams, culverts, siphons, etc. (PO1)
CO 2: Identify seepage under hydraulic structures and protection methods. (PO1)
CO 3: Analyze and design different hydraulic structures dams, culverts, siphons, and reservoir. (PO3)
CO 4: Justify the series steps taken to solve the hydraulic structures problems. (PO2)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Define basic theories of hydraulic structure design concepts- dams, culverts, siphons, etc.	Scope of hydraulic engineering; Dam hydraulics; Review of basic concepts in Hydraulics.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Identify seepage under hydraulic structures and protection methods.	Design discharge of spillway; Overflow types ; Frontal overflow; Side channel. Chute ; Free fall ; Cascade spillway	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Analyze and **design** different hydraulic structures dams, culverts, siphons, and reservoir	Hydraulic jump and stilling basin ; Drop structure and plunge pools	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Justify the series steps taken to solve the hydraulic structures problems.	Design of septic tank system. Activated sludge process. Trickling filter design.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Coastal Engineering	Course Code	CE 449	Credit Hour	2.0
		Contact Hours/week	2.0	Prerequisite	N/A
Synopsis	Coast and coastal features; tides and currents; tidal flow measurement; waves and its characteristics; forces of waves and tides in the design of coastal and harbor structures; coastal water level fluctuation - storm surge, tsunami and basin oscillation; coastal zone processes; deltas and its characteristics; estuary and estuary control; docks and harbors; design of shore protection works				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Calculate sea state parameters (wave height, wave period, water levels- storm surge). (PO2)

CO 2: Describe measurement systems for measuring/estimating waves, tides. (PO3)

CO 3: Develop knowledge about harbor planning, coastal sediment transport processes and its estimation. (PO1, PO2)

CO 4: Develop knowledge about different types of shore protection works and design principles. (PO3)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Calculate sea state parameters (wave height, wave period, water levels- storm surge).	Coastal zone of Bangladesh and its management, Tides and currents, tidal flow measurement	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Describe measurement systems for measuring/estimating waves, tides.	Tidal characteristics of Bangladesh.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge about the harbor planning, coastal sediment transport processes and its estimation.	Docks and harbors, Storm surge, Tsunami.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam
Develop knowledge about different types of shore protection works and design principles.	Different types of Shore protection works, Design of shore protection works.	Lecture, Hand/Multimedia Demonstration	Class Tests, Assignment, Final Exam

Course Title	Water Resources Engineering Lab	Course Code	CE 448	Credit Hour	1.5
		Contact Hours/week	3.0	Prerequisite	N/A
Synopsis	This course has been designed to discuss the major topics of water resources engineering such as - design of hydraulic structures, river training works. Ground water resource assessment and water well design.				

Course Learning Outcomes (COs): Upon completion of the course, the students will be able to –

CO 1: Design hydraulic structures including its stability and maintenance. (PO3)

CO 2: Introduce the need for river training and techniques for bank stabilization.(PO2)

CO 3: Analyze groundwater data and understand groundwater quality, availability.(PO4)

CO 4: Determine well location, design and installation of well. (PO12, PO5)

Course Learning Outcomes (COs)	Course Content	Teaching Learning Strategy	Assessment Strategy
Design hydraulic structures including its stability and maintenance.	Classification of hydraulic structures, Design and construction of hydraulic structure (dams), Flood control, Irrigation.	Lecture, Hand/Multimedia Demonstration, Practical Exercise.	Assignment, Viva, Quizzes
Introduce the need for river training and techniques for bank stabilization.	Importance of river training. Different modes of river bank failure, Techniques for bank stabilization, Different approaches of waterway control.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Analyze groundwater data and understand groundwater quality, availability.	Groundwater resource classification, Groundwater-Surface water interactions, Groundwater recharge, Water quality assessment.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes
Determine well location, design and installation of well.	Water well basics, Components of a well, Studies on well location, Water well design and installation, Well development, Wellhead protection.	Lecture, Hand/Multimedia Demonstration	Assignment, Viva, Quizzes

Following Figures & Tables provides proposed Sample Assessment Methods of COs for CE Courses:

CO-PO Assessment Marks, Course: CE XXX (Theory), Semester-Year																				
Assessment Types	Class Tests						CT Marks	CT Marks	Class Assessments		Class Assessment	Class Assessment	Final Exam					Final Exam Marks	Final Exam Marks	Total Marks
	Test 1	Test 2	Best CT	Test 3	Test 4	Best CT			Class Performance	Assignment/ Presentation			Q1	Q2	Q3	Q4	Q5			
Course Outcomes (COs)	CO1	CO1	CO1	CO3	CO3	CO3	CO1 & CO2	CO1 & CO2	CO2	CO2	All COs	All COs	CO1	CO4	CO2	CO3	CO1	All COs	All COs	
Program Outcomes (POs)	PO2	PO2	PO2	PO6	PO6	PO6	PO2 & PO4	PO2 & PO4	PO3	PO3	All POs	All POs	PO	PO	PO	PO	PO	All Pos	All Pos	
Distribution of Marks	20	20	10	20	20	10	20	20%	5	5	10	10%	14	14	14	14	14	70	100%	100
Sl. No.	ID	Name																		
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

CO-PO Assessment Marks, Course: CE XXX (Theory), Semester-Year. [OBE Method]

CO & PO Attainment, Course: CE-XXX (Theory), Semester-Year																				
ID	Name	Marks Attained in COs				Marks Attained in POs		CO- Attainment				PO-Attainment		CO-PO Attainments						
														Attainment of COs					Attainment of POs		
		PO4	PO2																	
		CO1	CO2	CO3	CO4	PO4	PO2	CO1	CO2	CO3	CO4	PO4	PO2	CO	CO	CO	CO	CO	PO	PO	PO
		∑CO1	∑CO2	∑CO3	∑CO4	∑PO4	∑PO2	∑CO1	∑CO2	∑CO3	∑CO4	∑PO4	∑PO2	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N

CO-PO Attainment, Course: CE XXX (Theory), Semester-Year. [OBE Method]

Course Assessment Report (CAR), Course code: CE XXX (Theory), Semester-Year								
Course name: Section: Course Teacher:								
Total number of students in this course								
CAR of COs					CAR of POs			
Learning Outcomes (COs)	Semester-Year				Program Outcomes (POs)	Semester-Year		
	CO attainments			Action plan of non-attainable COs / improve COs attainment in next semester		PO attainments		Action plan of non-attainable PO
	No. of students	%	Attainment			No. of students	%	Attainment
CO1				Will provide: more emphasis on LO1 in lecture and assignments and closely monitor progress of students	PO1			Will provide: more emphasis on LOs related to PO1 in lecture and closely monitoring the progress
CO2				Will maintain plan of previous semester and will closely monitor the progress of students to improve LO2	PO2			Will maintain plan of previous semester and will closely monitor the progress of students to improve LO2, LO3 and LO4 to improve PO2
CO3				Will maintain plan of previous semester and will closely monitor the progress of students to improve LO3	PO6			Will provide: more emphasis on LO5 (complex problem) and closely monitor progress
CO4				Will maintain plan of previous semester and will closely monitor the progress to improve LO4				
CO5				Will provide: more emphasis on LO5 in lecture and assignments and closely monitor progress.				
Proposed Attainment of LO and PO of the course= if 50~60% students pass the particular LO and PO								
*Attainment marks should be based on the decision of the academic council of the University								

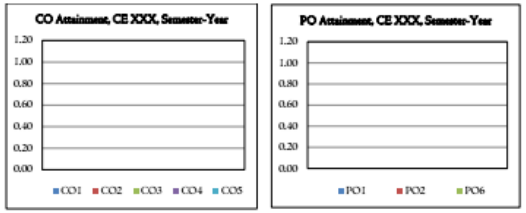


Figure: Graphical Representation Template for CO & PO Attainment.

Attribute		Knowledge Profile (K1~K8) & PO (PO1~PO12) Mapping	
		PO No.	Knowledge Profile (K1~K8)
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline	PO1	K1, K2, K3, K4
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline	PO2	K1, K2, K3, K4
		PO3	K5
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline	PO4	K8
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline	PO5	K6
		PO6	K7
K5	Knowledge that supports engineering design in a practice area	PO7	K7
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline	PO8	K7
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability	PO9	K7, K8
		PO10	K8
		PO11	K6-K8
K8	Engagement with selected knowledge in the research literature of the discipline	PO12	K7

Table: Sample Mapping Design Steps with Complex Engineering Problem Types (P1-P7)

Design Steps	Complex Engineering Problem Types
Define the Problem	P2
Gather Information	P2, P4, P6
Generate multiple Solution	P3, P7
Analyze and select a Solution	P1, P3, P5
Test and Implement Solution	P1, P5